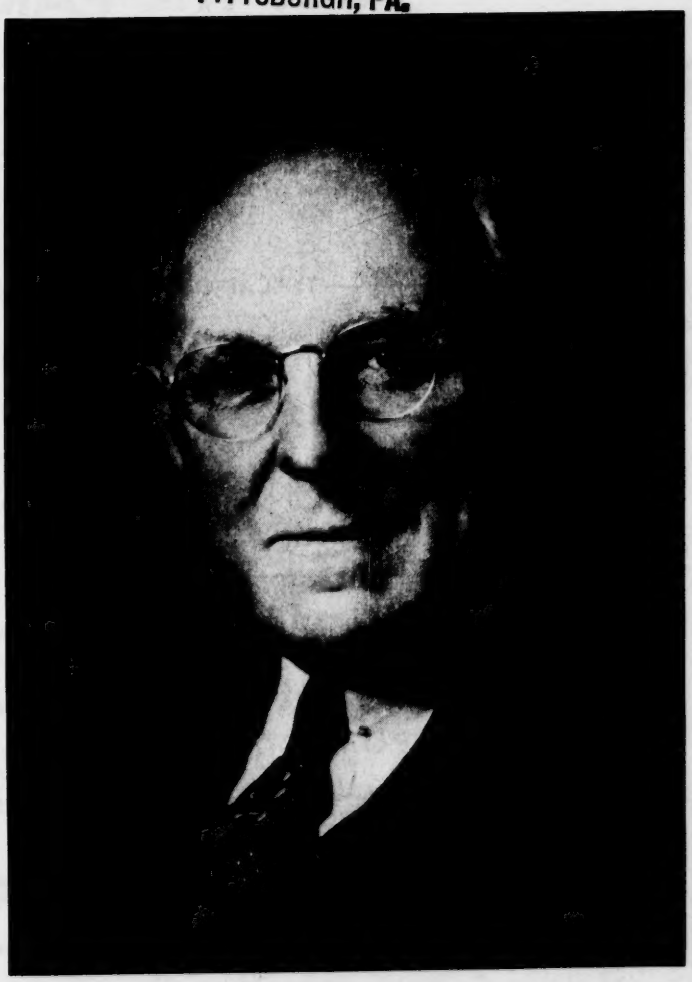
Metals Review

PITTSBURGH, PA.



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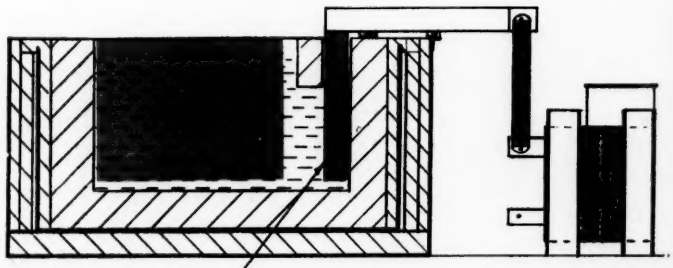

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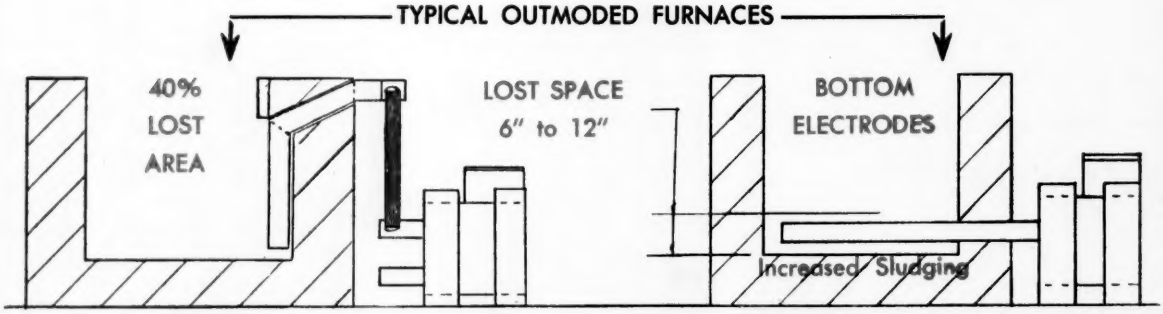

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Metals Review

The News Digest Magazine

January 1957

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Ray T. Bayless, Publishing Director

Marjorie R. Hyslop, Editor

Betty A. Bryan, Associate Editor

A. P. Ford, Sales Manager

G. H. Loughner, Production Manager

●

DISTRICT SALES MANAGERS

William J. Hilty
7301 Euclid Ave., Cleveland 3, Ohio
UTah 1-0200

John B. Verrier, Jr.
James P. Hontas
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New York 17, N. Y.
OXford 7-2667

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20050 Livernois St.
Detroit 21, Mich.
UNiversity 4-3861

Victor D. Spatafora
53 West Jackson Blvd.
Chicago 4, Ill.
WAbash 2-7822

●

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"Bill" Woodside, Founder Member, Past President A.S.M., Dies in Arizona

William Park Woodside, long known in Detroit as the "dean" of alloy steels, died on Dec. 5, 1956, in Phoenix, Ariz.

For 40 years Mr. Woodside was intimately connected with the metal industry of Detroit. He was one of that large group of men who in the first half of the twentieth century built up Detroit's mammoth automotive and metalworking industry. He was born in Bruce County, Ont., in 1877, son of a blacksmith, who in time taught him his trade and started his education on toolsteel and its heat treatment. After a few years of practice at U.S. Casterline Co., Pittston, Pa., the young Woodside started in business as a general blacksmith in Detroit. He had learned how to forge steel and had the opportunity of putting some of his heat treating education to practical use. He also developed a few tempering ideas of his own. This experience convinced him that heat treating and metallurgy of alloy steel was to be his life-long specialty.

In 1905, Mr. Woodside gave up his business to go with Cadillac Motor Co. After a year or so he started selling toolsteel to the budding automotive industry for Crucible Steel Co. of America. He stayed with Crucible for ten years, being manager of its Detroit office when he left in 1916 to become head of the Methods and Standards Department of Studebaker Corp., then a leading factor in the automotive business. During the years he held the position, he was not only active in alloy steel development, but also trained many young men who are today the backbone of the alloy steel industry.

In 1926 he joined Climax Molybdenum Co., where he was vice-president in charge of research until his retirement in 1943. He was at one time president of American Twist Drill Co., and at the time of his death was chairman of the board of Park Chemical Co.

Mr. Woodside's foresight gave him unshakeable faith in alloy steels and their future. During his career he accumulated a vast store of knowledge and practical experience that he gladly shared with technical men of the automotive industry. Undoubtedly, he will be remembered longest for the idea that has been of more benefit to the steel treating industry than any other, the formation of an association of practical steel treaters.

To understand the background of cooperation among metals men that today makes available for the country's needs the pooled technical knowledge of engineers, steel treaters and fabricators, it is necessary to go back to only a few years before World War I, to learn how such cooperation began and the part Mr. Woodside played in fostering it. At that time, a metallurgical engineer for one company had not the slightest idea what an engineer in a similar position for a firm in the same field was doing in the interest of metallurgical progress, and practical workmen of both companies seldom knew what the metallurgical engineers were doing or why. The result was almost complete general ignorance and confusion confounded by pseudo-technical hocus-pocus. Regarding this fog with the penetrating eye of common sense, Mr. Woodside talked to the men to whom he sold steel of an association to exchange ideas and information and to interest technical men and metallurgists in practical steel treating problems. In October 1913, he gathered 18 steel treaters of the Detroit area together in a meeting at the Steel Treaters' Club, then the Steel Treaters' Research Society, and later the American Society for Metals; it now numbers 27,000 members. Throughout all the changes and developments of the Society, Mr. Woodside took an active part in its affairs.

Mr. Woodside was a member of the American Academy of Sciences and a life member of Ashlar Lodge No. 91 F.A.M., a 32nd degree Mason and a Shriner. He was a member of the Detroit Golf Club and the Detroit Athletic Club. He is survived by his wife, Ruth, his son, William Park, Jr., and two granddaughters.

Presents Woodside Lecture in Detroit

Robert F. Mehl, Carnegie Institute of Technology, Presented the Annual William Park Woodside Lecture in Detroit Recently. He spoke on the "Formation of Ferrite and Bainite From Austenite". Shown with an oil painting of Mr. Woodside, who passed away in Arizona in December, are, from left: R. Chapman, chairman; Dr. Mehl; and V. A. Crosby, technical chairman

Speaker: R. F. Mehl

Carnegie Institute of Technology

The 14th annual William Park Woodside Lecture was presented before the **Detroit Chapter** by Robert F. Mehl, dean of graduate studies and head of department of metallurgical engineering, Carnegie Institute of Technology. Dr. Mehl's subject was "The Formation of Ferrite and Bainite From Austenite". Detroit chairman, R. D. Chapman, opened the meeting with a brief review of the background of the Woodside Lecture, and then introduced the technical chairman, V. A. Crosby, past chairman, who referred to the excellent portrait of Mr. Woodside on the stage, loaned to the Chapter for the evening by his son, W. P. Woodside, Jr. Mr. Crosby referred to his association with Mr. Woodside by stating that "to those of us who knew him, W. P. Woodside stimulated in us the desire to do the very best we knew". (See Obituary this page.)

Dr. Mehl indicated that he would speak of the elementary facts of the decomposition of austenite as the scientist sees them. He spoke first of the formation of pro-eutectoid ferrite in carbon steels, citing as the main variables affecting the shape and mode of formation of ferrite crystals—temperature, percent carbon, and the grain size of the parent austenite. He showed a series of excellent photomicrographs illustrating the morphology of ferrite. Ferrite occurs in three forms: As a precipitate along the grain boundary of the parent austenite; as ferrite side plates growing from an austenite boundary, often in conjunction with grain boundary ferrite; and as Widmanstatten platelets nucleating within the parent austenite grain.

Dube at Carnegie Institute of Technology has catalogued these types of ferrite, and Dr. Mehl showed

(Continued on p. 5)

(*Contnued from p. 4*)

MELLON INST... LIBRARY ... PITTS...

iron-carbon diagrams on which were outlined the mode of ferrite formation as influenced by austenite grain size.

Dr. Mehl cited the work of Aaronson at Carnegie in which he has found evidence that low energy boundaries (low angle boundaries) give rise to the "side plate" ferrite formation, and postulated that this mode of formation was associated with the occurrence of edge dislocations. One might logically assume that at higher energy boundaries the dislocations are so numerous or the structure so disordered as to give rise to massive or grain boundary ferrite rather than ferrite "side plates". This energy concept of ferrite morphology is further supported by the evidence of the influence of temperature on type of ferrite. The Widmanstatten and side plate ferrite occur with increasing frequency with decreasing temperature and occur at higher temperatures in large grain steels.

Dr. Mehl discussed the attempts at measurement of the growth of ferrite and the relationship of plate growth to the "point effect" of diffusion. He indicated that one must assume protuberances to activate the point effect of diffusion, and indicated that protuberances may result from localized matching of the octahedral planes of the parent austenite and the newly forming ferrite.

The work of Paxton and Heckel at Carnegie has shown considerable similarity between the modes of formation of pro-eutectoid cementite and those of pro-eutectoid ferrite. Pro-eutectoid cementite occurs intragranularly as parallel platelets or "sheaves". Dr. Mehl showed a series of photomicrographs illustrating the modes of formation of cementite, which reinforced the general theory that orientation of austenite grain boundaries affects the morphology of the transformation constituent.

A "modern" definition of bainite was given by Dr. Mehl as "carbide precipitate from supersaturated ferrite plus austenite nucleated carbide". He supported this definition by presenting a postulated diagram in which one could visualize the supersaturation of ferrite as an undercooling effect. The occurrence of "sheaves" or fine lamellae of plates of bainite is similar to that observed in pro-eutectoid cementite and was tentatively attributed to "sympathetic nucleation" originating from microstrains in the austenite.—**Reported by D. V. Doane for Detroit.**

A. S. M. has produced and makes available for showing before chapters and educational institutions moving picture films pertaining to metals.

Speaks on Alloying at Oak Ridge

Sheldon Weinig (Left), Assistant Professor of Metallurgy, New York University, Spoke on "Alloying for High-Temperature Strength" at a Meeting in Oak Ridge. He is shown with J. R. Weir, technical chairman

Speaker: Sheldon Weinig
New York University

Members of the **Oak Ridge Chapter** heard a novel approach to the problem of creep in a talk entitled "Alloying for High - Temperature Strength" given by Sheldon Weinig, assistant professor of metallurgy, New York University.

Dr. Weinig pointed out that the creep process in metals involves the matrix, the substructure and the grain boundaries.

He pointed out that the matrix and grain boundary contributions are related in a manner which is not yet clearly defined. The grain boundary contribution varies from 10 to 50% of the total strain, increasing with temperature. The mechanisms for matrix deformation are primarily glide in the transient portion of the creep curve and dislocation climb in the quasi-viscous portion.

The speaker stated five rules for obtaining an alloy with high strength. They are:

1. Use a base metal with a high melting point.
2. Use solute atoms with spectrums of diffusivity so that the Cottrell mechanism is operative at all strain rates and temperatures.
3. Utilize a stable precipitate that will hinder easy glide by pinning dislocations.
4. Cause an aging reaction to occur while deformation is occurring to prevent climb.
5. Cold work and polygonize the alloy to obtain subboundaries to slow deformation.

—**Reported by A. Goldman for Oak Ridge Chapter.**

Gives Tips at Jackson On How to Minimize Heat Treating Headaches

Speaker: N. O. Kates
Lindberg Steel Treating Co.

Norman O. Kates, Lindberg Steel Treating Co., presented a talk on "Minimizing Heat Treating Headaches" at the first regular meeting of the **Jackson Chapter.**

Mr. Kates spoke from the heat treating point of view in trying to point out the factors that must be considered for successful heat treatment. Heat treatment is important because all the sweat and tears of front-office aggravation is invested in that chunk or chunks of metal, and any error of judgment, design, materials or equipment can scrap every man-hour consumed, not to mention the cost or tie-up of production.

Fundamentally heat treatment is designed to produce a tool or part that will stand up in service. The mechanics of heat treatment is to obtain certain specified properties in the metal by the controlled cycles of heating and cooling, at the same time minimizing warpage or distortion, excessive volume changes, and above all, avoiding cracking.

Successful heat treatment and good service life is dependent on keeping stresses induced by heat treatment to a minimum. For, during heat treatment, stresses result principally from differential heating and cooling. The temperature differential is largely a function of the size or shape of the part.

Mr. Kates used slides to illustrate his discussion.—**Reported by John A. Richter for Jackson.**

Appointments to A.S.M. Standing Committees

At the meeting of the Board of Trustees of the American Society for Metals held Aug. 30-31, appointments to various national committees of the Society were announced by President-Elect Clark and confirmed by the Board. The complete personnel of the standing committees is listed below. The new appointments are shown in italics and the numerals represent the date of expiration of the appointment. Chapter affiliations are listed rather than employment addresses.

Handbook Committee

N. E. Promisel, Bureau of Aeronautics, Washington, '57, Chairman.
M. L. Frey, Allis-Chalmers Manufacturing Co., Milwaukee, '57.
S. R. Callaway, General Motors Corp., Electro Motive Div., Chicago, '57.
T. A. Frischman, Eaton Manufacturing Co., Cleveland, '57.
Ralph Leiter, Budd Co., Philadelphia, '57.
George Perkins, Reynolds Metals Co., Louisville, '57.
C. W. Briggs, Steel Founders' Society of America, Cleveland, '57.
Arthur R. Oakley, Steel & Machine Tool Sales Co., Texas, '57.
G. F. Kappelt, Bell Aircraft Corp., Buffalo, '58.
J. J. Repko, National Advisory Committee for Aeronautics, Cleveland, '58.
S. R. Prance, Inland Manufacturing Div., Dayton, '59.
N. J. Grant, Massachusetts Institute of Technology, Boston, '59.
G. P. Phillips, International Harvester Co., Chicago, '59.
Leo Schapiro, Douglas Aircraft Co., Los Angeles, '59.

Transactions Committee

R. D. Chapman, Chrysler Corp., Detroit, '57, Chairman.
D. J. Carney, U. S. Steel Corp., Chicago, '57, Past Chairman.
G. W. Birdsall, Reynolds Metals Co., Louisville, '57.
H. J. Elmendorf, American Steel & Wire Co., Worcester, '57.
Glenn A. Fritzlen, Haynes Stellite Co., Purdue, '57.
J. F. Libsch, Lehigh University, Lehigh Valley, '57.
R. I. Jaffee, Battelle Memorial Institute, Columbus, '57.
George Enzian, Jones & Laughlin Steel Corp., Pittsburgh, '58.
H. Y. Hunsicker, Aluminum Co. of America, Cleveland, '58.
William A. Reich, General Electric Co., Detroit, '58.
Daniel J. Girardi, Timken Roller Bearing Co., Canton-Massillon, '58.
Paul G. Nelson, Budd Co., Philadelphia, '58.
John Dorn, University of California, Golden Gate, '59.
John C. Fisher, General Electric Co., Eastern New York, '59.
J. H. Bechtold, Westinghouse Electric Corp., Pittsburgh, '59.
E. M. Mahla, E. I. du Pont de Nemours & Co., Philadelphia, '59.
Morris Cohen, Massachusetts Institute of Technology, Boston, '59.

Constitution and By-Laws Committee

M. E. Huether, Revere Copper & Brass Inc., St. Louis, '57, Chairman.
R. E. Layton, O. A. Sutton Corp., Wichita, '57, Past Chairman.
G. M. Snyder, Northeast Pennsylvania, '57.
Kenneth MacKenzie, International Business Machines Corp., Southern Tier, '58.
William F. Eberly, Vanadium Alloys Steel Co., Philadelphia, '58.
P. K. Raiford, Kaiser Aluminum & Chemical Corp., New Orleans, '59.
M. V. Walber, Viking Forge & Steel Co., Golden Gate, '59.
G. E. Shubrooks, Hamilton Watch Co., Representative of Board of Trustees, York.

Finance Committee

C. H. Lorig, Battelle Memorial Institute, Columbus, Chairman.
Erith T. Clayton, Tainton Co., Baltimore, '57.
Bob Daykin, Ladish Co., Milwaukee, '57.
Zay Jeffries, Cleveland, '57.
K. R. Van Horn, Aluminum Co. of America, Pittsburgh, '58.
J. P. Fowler, Texas Steel Co., North Texas, '59.
W. F. Nash, Jr., C. F. Braun & Co., Los Angeles, '59.
A. A. Hess, American Society for Metals, Cleveland, '59.

Vocational Education Committee

W. E. Frank, Caterpillar Tractor Co., Peoria, '57, Chairman.
T. J. Hughel, Purdue University, Detroit, '57.
O. E. Cullen, Surface Combustion Corp., Toledo, '57.
Albert R. Fairchild, Western Electric Co., Carolinas, '57.
Jacob Gantner, National Cash Register Co., Dayton, '57.
E. L. Bartholomew, Jr., University of Connecticut, Hartford, '58.
Elmer Gammeter, Babcock & Wilcox Co., Milwaukee, '58.
Joseph Gurski, Ford Motor Co., Detroit, '58.
C. A. Higgerson, New York State University Institute, Rome, '58.
W. Alderson, General Motors Corp., Indianapolis, '59.
B. R. Queneau, U. S. Steel Corp., Pittsburgh, '59.
R. F. Hehemann, Ex Officio, Chairman Advisory Committee Metallurgical Education.
C. E. Swartz, Representative of the Board of Trustees, Chicago-Western.

C. E. Swartz

R. Maddin

R. D. Chapman

D. J. Blickwede

Appointments to A.S.M. Standing Committee

(continued)

Seminar Committee

R. Maddin, University of Pennsylvania, Philadelphia, '57, Chairman.

Bruce Chalmers, Harvard University, Boston, '57, Vice-Chairman.

P. A. Beck, University of Illinois, Peoria, '57, Past Chairman.

B. Averbach, Massachusetts Institute of Technology, Boston, '57.

John Fisher, General Electric Co., Eastern New York, '57.

Thornton Read, Jr., Bell Telephone Laboratories, New Jersey, '57.

J. S. Koehler, University of Illinois, Peoria, '58.

M. B. Bever, Massachusetts Institute of Technology, Boston, '58.

Pol Duwez, California Institute of Technology, Los Angeles, '58.

J. J. Harwood, Office of Naval Research, Navy Department, Washington, '59.

F. L. Vogel, University of Pennsylvania, Philadelphia, '59.

R. L. Smith, Franklin Institute, Philadelphia, '59.

W. D. Robertson, Yale University, New Haven, '59.

W. R. Hibbard, Jr., General Electric Co., Eastern New York, '59.

Advisory Committee on Metallurgical Education

R. F. Hehemann, Case Institute of Technology, Cleveland, '57, Chairman.

Morris Cohen, Massachusetts Institute of Technology, Boston, '57.

J. W. Ludewig, Carnegie Institute of Technology, Pittsburgh, '57.

J. U. MacEwan, McGill University, Montreal, '57.

Kenneth E. Rose, University of Kansas, Kansas City, '58.

Robert Sweet, Michigan State College, West Michigan, '58.

A. W. Grosevenor, Drexel Institute of Technology, Philadelphia, '58.

H. W. Paxton, Carnegie Institute of Technology, Pittsburgh, '59.

H. H. Bliss, University of Oklahoma, Tulsa, '59.

R. M. Parke, General Electric Co., Eastern New York, '59.

G. A. Fisher, Jr., International Nickel Co., Representative of the Board of Trustees, St. Louis.

Metal Progress Advisory Committee

H. J. Nichols, Physical Metallurgy Research Laboratory, Ottawa Valley, '57.

Don Rosenblatt, American Foundry & Machine Co., Utah, '57.

Leo P. Tatasov, Norton Co., Worcester, '57.

John W. Sweet, Boeing Airplane Co., Puget Sound, '58.

E. H. Snyder, Austin Western Div., Baldwin-Lima-Hamilton Corp., Chicago-Western, '59.

W. A. Stadtler, International Business Machines Corp., New York, '59.

M. H. Brown, E. I. Du Pont de Nemours & Co., Philadelphia, '59.

G. M. Young, Aluminum Co. of Canada, Ltd., Representative of Board of Trustees, Montreal.

Education Sub-Committee

D. J. Blickwede, Bethlehem Steel Co., Lehigh Valley, '57, Chairman.

W. T. Lankford, U. S. Steel Corp., Pittsburgh, '57, Past Chairman.

Melvin R. Meyerson, National Bureau of Standards, Washington, '57.

A. U. Seybolt, General Electric Co., Eastern New York, '57.

Scott Henry, A. O. Smith Corp., Milwaukee, '57.

Richard Doughton, National Academy of Science, Pittsburgh, '57.

D. H. Ruhnke, Republic Steel Corp., Canton-Massillon, '57.

T. E. Piper, Northrop Aircraft, Inc., San Diego, '57.

E. S. Machlin, Columbia University, New York, '57.

At Chicago-Western's Metallurgy Forum

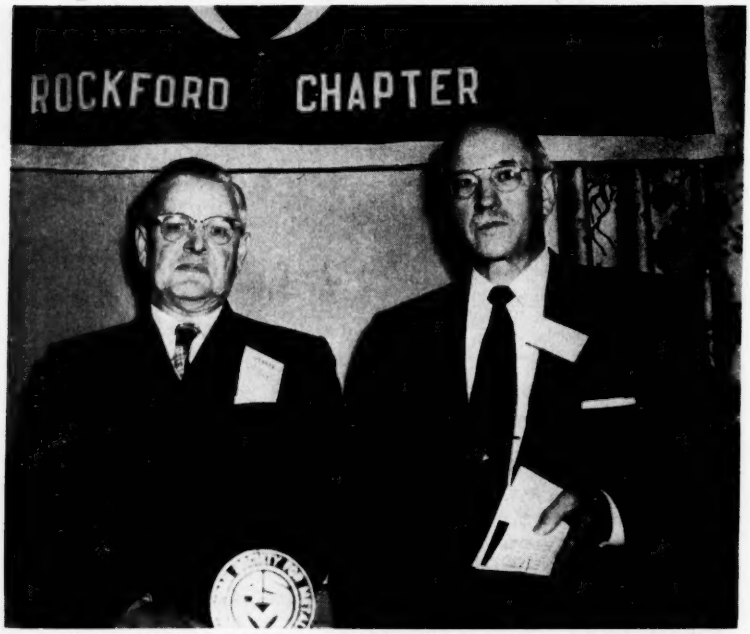
A. McDonald (Left) and L. Jacobsmeyer, Both of Salkover Metal Processing of Illinois, Show Samples of Various Brazed Parts to Interested Students at the Chicago-Western Chapter's Second High School Metallurgy Forum

The **Chicago-Western Chapter** recently sponsored its second High-School Metallurgy Forum at Leyden Community High School, Franklin Park, Ill. Intended to interest high-school students in the field of engineering in general and metallurgy in particular, the Chapter's student affairs committee played host to almost 400 students from 19 west suburban high schools.

Committee Chairman Fred W. Kisslinger, professor of metallurgy, Illinois Institute of Technology, and originator of the forum as a means of student contact, presided over the meeting in the school auditorium. Norman O. Kates, chief metallurgist, Lindberg Steel Treating Co., presented a talk on "Metallurgy as a Science and Career", describing to the assembled students the function of metallurgy in modern society and its close relation to other sciences. He also told of the many personal advantages and fields of opportunity for those who study metallurgical engineering. Philip B. Lottich, director of admissions, Illinois Institute of Technology, spoke on the subject "Plan Early and Well", emphasizing that the high-school subjects of mathematics, chemistry, physics and English are indispensable in gaining admission to any engineering school. He urged early planning of high-school courses to include these subjects.

Following the talks, the students examined 37 exhibits sponsored by industrial concerns. Each exhibit was planned to illustrate some phase of metallurgy. These were in the fields of extractive metallurgy, pyrometry, testing and inspection, failure analysis, corrosion, drawing, refractory metals, application and fabrication, metals and alloys, casting, hot working, joining, finishing, powder metallurgy and nuclear metallurgy. The entire program was planned to give the many interested students a better idea of the scope of the metallurgical profession so that they may be in a better position to consider it as a career.—**Reported by D. J. Wulpi for Chicago-Western.**

Speaks in Rockford on Nodular Iron



T. E. Eagan (Left), Chief Research Metallurgist, Cooper-Bessemer Corp., Is Shown With D. A. Campbell, Chairman, at a Meeting Held Recently by the Rockford Chapter. Mr. Eagan presented a talk entitled "Nodular Iron"

Speaker: T. E. Eagan
Cooper-Bessemer Corp.

The **Rockford Chapter** celebrated its 35th anniversary during a recent meeting. Attending were four of the founder members, John B. Frederick, George Nash, J. R. Rossier and C. V. White.

T. E. Eagan, chief research metallurgist, Cooper-Bessemer Corp., presented a talk on "Nodular Iron".

Nodular iron can be melted in both basic or acid cupolas, but basic cupolas are most used due to the low sulphur yielded in the basic melt. It is essential to have a very low sulphur content in nodular iron as it has a detrimental effect on mechanical properties. Magnesium is added to lower the sulphur content, but a new process is under investigation in which calcium carbide is blown into the ladle.

In the as-cast state, nodular iron has a structure of nodular carbon plus pearlite and has low ductility. In the annealed state its structure is nodular carbon plus ferrite and it has good ductility.

Tin, lead, antimony, copper and titanium are considered as subversive elements as they detract from the mechanical properties. Cerium is usually added to get rid of these subversive elements.

Some of the properties of nodular iron are good flowability, higher shrinkage than gray iron, section sensitive in as-cast state, but not in heat treated condition, impact values at lower temperatures almost identical to those of cast steel and rolled mild steel, and good resistance to growth during heating.

Nodular iron has been assigned A.S.T.M. designations A 339-55T, A 395-55T, and A 396-55T.

Mr. Eagan concluded by describing some of the applications of nodular iron. Typical uses are in pressure vessels, pistons, engine parts, shipboard uses, gears and high-temperature applications.—**Reported by Joe Sisti for Rockford.**

Good Luck to the A(rgentine) S. M.!

Director
American Society for Metals
7301 Euclid Ave.,
Cleveland 3, Ohio

Esteemed Sir:

Earlier this year, an assembly met in the faculty of exact sciences of the University of Buenos Aires and constituted itself into the "Sociedad Argentina de Matales" (Argentine Society for Metals), to be dedicated on Dec. 20, 1956.

The program of our Association is condensed into the following resume:

(a) To promote the knowledge of technical metallurgy, technologically and scientifically, to develop, coordinate and orient investigation and research, to attract persons dedicated to it or interested in enrolling, and to maintain a high professional standard among its members.

(b) To organize a library composed of publications which relate directly or indirectly to metallurgy, consisting of all those publications which are received or exchanged with other institutions, as well as books and magazines acquired through purchase or gift.

(c) To foster relations with or associate with similar institutions, foreign or international.

(d) To call and organize congresses.

To establish these aims, we are anxious to promote contact with your institution. At the present time our scope is rather limited since the first executive board began to function only after election at the first extraordinary assembly, held on July 31, 1956.

President ..... Antonio E. Sturla
Vice-President ..... Salvador D. Capocasale
Secretary Carlos Fernandes Molina
Assistant Secretary ..... Hector F. Antelo
Treasurer ... N. H. A. de Libanati
Assistant Treasurer ..... Norma Lindenvald
Directors ..... Armando Alzati
..... Jorge S. Muntaner Coll
..... Julio Hector Ruiz
Alternate Directors ..... Carlos Alfrendo Carreras
..... Jorge Alberto Sabato
..... Guillermo Uriburu

The meeting place of the Institution is Diagonal Roque Saenz Pena 555—8 Piso, Buenos Aires.

With no other object but to consolidate the relations which have been established between us up to the present, I am most cordially yours,

Antonio E. Sturla
President

Tells Problems of High-Speed Flight in Washington

Speaker: John F. Victory
National Advisory Committee for Aeronautics

John F. Victory, executive secretary, National Advisory Committee for Aeronautics, spoke on "Some Problems of High-Speed Flight" at the New Members and Students Night meeting in **Washington.**

Dr. Victory traced the history of the development of heavier than air flight and reminded his listeners of the exacting demands for performance that future aircraft will impose upon engineering materials.

Dr. Victory also stressed the important relationship between technical progress and a stable, technically qualified staff in aircraft research and development. He touched on the problems of reconciling the needs of scientifically trained personnel with the regulations and limitations imposed by the Civil Service Commission.—**Reported by Frank P. Huddle for Washington.**

Peoria Hears Talk on Trends in Carburizing

Speaker: E. S. Rowland

Timken Roller Bearing Co.

E. S. Rowland, chief metallurgical engineer, Timken Roller Bearing Co., presented a talk on "Trends in Carburizing" at a recent meeting in **Peoria.**

Because of the many subtopics possible under the general topic carburizing, Dr. Rowland covered only two specific facets of carburizing being of main interest to people in the field of production carburizing. These are control of case depth and maximum carbon content, and residual stresses in carburized parts.

The discussion was based on the result of studies of the above factors in his own organization.

Dr. Rowland first outlined the steels and test methods used as standard practice at Timken. The two main steels are SAE 4620 and 4720, the 4720 being a low nickel derivative of 4620. Carburizing is accomplished at 1700° F. and case depth is measured to a depth corresponding to 0.50% carbon. A short length of heavy walled tubing having the same chemistry and microstructure as the production parts is used as a test sample. These test samples are relatively inexpensive and convenient to use as they are machined directly from the tubing stock on hand and distortion during heat treatment is very low. In production practice the fracture method is used for determining the case depth, and the M_s method is used in the laboratory for referee control between plants.

Charts were presented by Dr. Rowland showing maximum carbon content and case depth control using random test samples from production carburizing under various carburizing conditions and controls over a period of years. One of the first furnaces was a gravity pit-type using raw natural gas with turbulence acquired only from the gas flow. Other conditions were: gas carburizing using carrier gas and natural gas in a fan-driven pit-type carburizer; pack carburizing in a continuous furnace converted from a ceramic furnace; gas carburizing in a continuous carburizer; oil drip carburizing in a batch carburizer. Earlier controls were all manual whereas later controls included automatic dew point control and automatic carbon potential control with a sensing wire in the carburizing atmosphere. Dr. Rowland emphasized the importance of maintaining simplicity in carburizing to attain good control by allowing time and temperature to be the only variables. Factors such as poor heat transfer in pack carburizing and poor dew point control due to manual determinations tend toward loss of control.

Residual stresses at Timken are measured by X-ray diffraction which is accurate to ±3000 psi. in both a longitudinal and circumferential direction on bearings. Dr. Rowland presented charts showing that compressive stresses ranging from 15,000 to 20,000 psi. can be expected on the surface from quenching which will increase to about 30,000 to 40,000 psi. when centerless ground as long as the grinding is not abusive. Doubling the case depth had the effect of increasing the residual stresses. It was found that very little change in the residual stress pattern was derived from cooling to −320° F. in order to eliminate retained austenite.

In the discussion period Dr. Rowland stated that microcracks were not evidenced in their own product. —**Reported by J. I. Ragee for Peoria.**

Student Affairs Committees Adopt "Action" for Motto

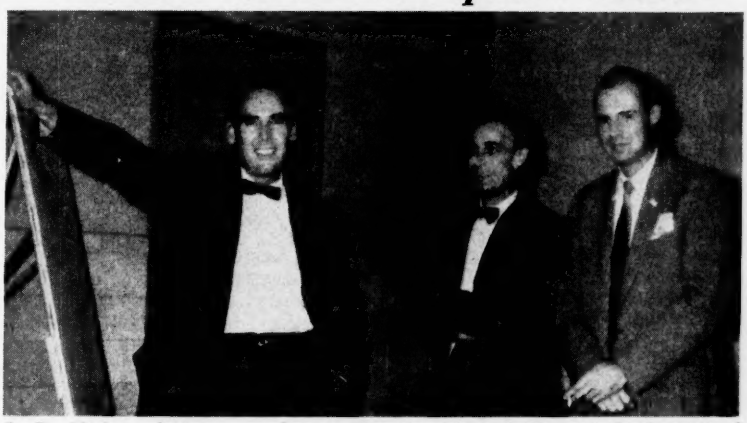
Reports keep coming into national headquarters from A.S.M. chapters with heartening news about their student affairs activities.

The battle for greater enrollment in college metallurgy is on with both barrels.

The list of chapters doing outstanding jobs is too long to describe here as fully as they each deserve, but all of them will understand this expression of thanks for jobs well done from the national secretary.

And the metalworking industry leaders will certainly owe much to these busy individuals for their stimulating influence upon hundreds of high-school students who will be their future metallurgical engineers. —W.M.

Discusses Advances in Special Metals



J. D. Nisbet, Assistant to Senior Vice-President, Universal Cyclops Steel Corp., Spoke on the "Impact of Technical Innovations on the Special Metals Business" at a Meeting Held by the Wilmington Chapter. Shown, from left, are: Mr. Nisbet; Robert Auld; and William Lusby, chairman

Speaker: J. D. Nisbet

Universal Cyclops Steel Corp.

The **Wilmington Chapter** heard J. D. Nisbet present a talk entitled "The Impact of Technical Innovations on the Special Metals Business" at a recent meeting. Mr. Nisbet is assistant to the senior vice-president, Universal Cyclops Steel Corp., and has had extensive experience in the field of metals for high-temperature applications.

The speaker pointed out that the search for better materials to perform special duty service at ultra-high temperatures has led to the investigation of metals such as columbium and molybdenum as well as others. Unfortunately, the metals which show promise for ultra-high temperature service are, for the most part, highly reactive and refractory. The reactive nature of these metals necessitates the exclusion of atmospheric gases during melting and hot working operations while their refractory nature requires extreme temperatures for successful hot working. Mr. Nisbet pointed out that present production equipment limits hot working temperatures to no more than about 2500° F. At this temperature, molybdenum is actually being "cold", or at best, "warm" worked and consequently exhibits a brittle behavior.

Work with these highly refractory and reactive metals has by necessity led to the rapid technological advances being made in the field of special equipment for melting and working. Developments such as the proposed pilot plant for the hot working of molybdenum in an inert gas atmosphere appear to be an answer to the problems. This proposed pilot plant will be in a room approximately 70 x 100 ft., and be completely equipped to perform hot working operations in the range of from 3500 to 4000° F. under a completely inert atmosphere. — **Reported by N. E. Whitcomb for Wilmington.**

Toolsteel Properties Given in Boston

H. G. Johnstin, Vanadium-Alloys Steel Co., Presented a Talk Entitled "Properties and Uses of Toolsteels" at a Meeting Held Recently by the Boston Chapter. Present were, from left: John L. Morosini, past chairman; Mr. Johnstin; Henry Hudson; and Harold D. Stuck, Chapter chairman

Speaker: H. G. Johnstin
Vanadium-Alloys Steel Co.

H. G. Johnstin, metallurgical engineer, Vanadium-Alloys Steel Co., presented a talk entitled "Properties and Uses of Toolsteels" before the **Boston Chapter** which shed new information on the selection of toolsteels for various uses. His slides showed that the toolsteel industry manufactured 115,900 net tons in 1955, which is relatively small as compared with 117 million net tons representing the total tonnage of all steel produced.

During the same year approximately 21% of the toolsteel made was the high speed type, 10% represented hot work die steels, 9% was steels containing 4.00% chromium or higher, 13% carbon toolsteel, and all the other toolsteels amounted to 46%. Of the high speed steels produced, the M-2 type represented 42%, M-1 24%, M-10 16%, and T-1 10%, with all the other types, including cobalt high speed steels, being 8%.

Toolsteels have been grouped according to whether the steels are water hardening, shock resisting, or used for cold or hot work. High speed toolsteels have been grouped into the tungsten and molybdenum-base types, and there is a general grouping of steels for special purposes. All these steels have been identified and given type classifications under A.I.S.I. symbols. The classification is general and does not attempt to limit chemical specification ranges.

In straight carbon steels, carbon runs from 0.70 to 1.40%. For toughness, such as chisels, 0.75% carbon seems to work best. For dies requiring toughness and resistance to wear, carbon is raised to around 1.00% and possibly 1.25%. This increases formation of iron carbide, which is essential for good wear in such applications. As alloying elements are added to straight carbon toolsteels, more complex carbides are formed. The difference between wearing qualities of carbon toolsteel and the higher alloy types is largely due to the difference in hardness of the complex carbides which are present. Iron carbide in a straight carbon toolsteel has an average microhardness of 790, while chromium carbide is 1820, aluminum oxide, 2440, and complex vanadium carbide, 2520. Wear resistance, hot hardness, toughness, hardenability, minimum distortion, machining and grinding ability are important properties found in toolsteels.

In testing toolsteels for hardenability, the Shepherd P-F test, as well as the P-V test, have found wide application. Abrasion resistance of toolsteels tested by Armour Research Foundation disclosed that the following factors affect wear resistance—the number of carbides present, the character or hardness of the carbides, and the hardness of the grain matrices into which the carbides are embedded.

Toughness of toolsteels combines yield strength and ductility. The former relates to the ability of the material to withstand stress without plastically deforming, whereas the latter relates to the amount of plastic deformation which can be tolerated prior to fracturing. Tensile tests are not applicable to high alloy materials, due to their low ductility values, but bend tests can determine their ductility. Impact properties of such steels have great importance. Resistance to softening at elevated temperatures is an important measurable property due to many toolsteels having to operate at elevated temperatures continuously. Here the importance of tempering temperature and the time element in obtaining maximum die life is important.

Many practical examples of good and bad life of such toolsteels dies were shown in slides illustrating their structure in service. Many interesting dies where excellent life is now obtained were studied, and others indicated that thermal fatigue still presents a problem for study. Today it is possible to produce and heat treat properly dies as heavy as 26,000 lb. Extrusion dies used on a 14,000-ton press for tubes and bars are giving excellent service today when made from the alloy toolsteels available.—**Reported by H. I. Dixon for Boston.**

Vacuum Melting of the Superalloys Described at Dayton Chapter Meeting

Speaker: F. Richmond
Universal-Cyclops Steel Corp.

Frank Richmond, manager of materials research, Universal-Cyclops Steel Corp., addressed the **Dayton Chapter** on the topic "Vacuum Melting of Superalloys", recently. Mr. Richmond used slides to demonstrate these melting techniques.

He described briefly the development of iron, nickel and cobalt-base superalloys, and pointed out that the primary obstacle in obtaining increased properties in these materials was the limitation of total alloying content imposed by the melting techniques. Vacuum melting has eliminated this obstacle and has resulted in greatly improved high-temperature properties. Improvements in such properties as resistance to creep, high-temperature rupture strength and elongation characteristics were discussed in detail. The speaker also made comparisons between conventionally melted and vacuum melted superalloys.

Mr. Richmond then mentioned briefly the "new" superalloys now on the horizon which will be based on refractory materials such as molybdenum and columbium. Although many of these alloys are still in the laboratory stage, an obstacle to their development has already arisen. This obstacle is fabrication difficulties due to the poor oxidation resistance of some of the alloys and the great difficulty encountered in forging such high-melting point alloys at normal temperatures. He described how Universal-Cyclops is attempting to eliminate this obstacle by construction of a room in which all of the air will be replaced by helium or some other inert gas. This room will be used to roll and forge these refractory alloys at the proper forging temperature and without any contamination from air during the fabrication process. To operate the equipment inside this helium-filled building, the workmen will be totally enclosed in leak-proof "space suits".—**Reported by R. A. Grayson for Dayton.**

Long Island Topic Is Nickel and the Precious Metals

Speaker: E. M. Wise

International Nickel Co., Inc.

At the opening meeting of the **Long Island Chapter**, E. M. Wise, assistant to the director of research and development, The International Nickel Co., Inc., covered the part that International Nickel is playing in the great effort of increasing the supply of nickel to match present and future demands. His talk was entitled "Origin and Uses of Nickel and Precious Metals".

A movie, "The Mining of Nickel", showed how the first great deposits of nickel and copper in Sudbury were discovered by prospectors and how geophysical methods are now being employed to discover hidden deposits. In this work much reconnaissance is done from aircraft utilizing magnetometers, and a new conductor-sensitive device which Inco developed under the general supervision of the speaker. These new devices aid in focusing on areas that merit detailed investigation on the ground and may be followed by drilling and very thorough study to determine their importance. The discovery of the completely covered Moak Lake deposit showed that these devices work.

E. M. Wise

The movie then showed, primarily by animation, the steps involved in converting a prospect into a mine and explained new mining methods being employed to permit handling of unprecedented quantities of ore and thus supply the constantly increasing demand for nickel.

The speaker mentioned his work in the early application of age hardening to silver alloys in 1922 and to large commercial use of age hardened gold watch cases the following year. In the course of this work he discovered the age hardening copper-nickel base alloys containing phosphorous, silicon or tin, all of which are now in commercial use.

Mr. Wise summarized the recent applications of the platinum group metals, which are now most important in the engineering and production fields. Palladium is principally used for electrical contacts in telephone and other communication devices, and platinum is the basis of the Fiberglas industry, the world's production of nitric acid, and practically all of the perchlorates, peroxides and similar compounds. Without platinum there probably would be no rocket program and without Fiberglas, lightweight motors, generators, etc., capable of operating at high temperatures, would be just a hope rather than a fact. The most recent large-scale application of platinum is as a catalyst in the production of a superior grade of gasoline. These uses are in addition to the older ones, including the jewelry industry, which are dependent upon the appearance and high corrosion resistance of platinum, palladium and rhodium.

The final portion of Mr. Wise's talk was devoted entirely to nickel and its alloys that are used so widely in the electrical and electronic fields where their low expansion properties, special magnetic characteristics and low gas content are essential. Nickel also possesses properties which make it suitable for the base of the cathodes in practically all of the small and moderate-size radio and television tubes. The trans-Atlantic telephone cable, which has just been christened, utilizes nickel-base cathodes in the deep sea portion and platinum-base cathodes in other portions of the cable. The first tubes were designed by Bell Telephone Laboratories-Western Electric and the second by the British Post Office Engineering Laboratories.

The broad range of uses of special platinum metal and nickel-base alloys is the result of cooperation between metallurgists, engineers, physicists and chemists and this is a healthy sign of future developments. —**Reported by W. R. Weinberger for Long Island Chapter.**

Spins Metallurgical Folklore Yarns at Purdue

Speaker: D. J. Mack

University of Wisconsin

The **Purdue Chapter's** annual ladies night meeting featured a talk by D. J. Mack, associate professor of metallurgical engineering at the University of Wisconsin. Dr. Mack presented an informal address entitled "Metallurgical Folklore".

Dr. Mack began his talk by quoting from the book *Tom Swift, Jr., and His Flying Laboratory* to familiarize the ladies with the work of a metallurgist. The passage selected concerned a problem of Tom's regarding a better high-temperature alloy. Tom's solution to this problem came after he "sprang from his bed early one morning, dashed to his laboratory and worked two entire days before arriving at the exact desired alloy".

During the course of the evening Dr. Mack presented a great many interesting anecdotes such as the one about Damascus steel and how the original swords of this steel were heat treated by plunging the fire-red blade into the back of a slave, and also the legend of the hardened copper helmet of Don Quixote.

The talk was followed by a brief question and answer session during which the ladies asked Dr. Mack questions concerning their metallurgical problems with such items as stainless steel cutlery and aluminum cooking utensils.—**Reported by K. Schneck for Purdue.**

National Officers at Cleveland

Shown at Cleveland's National Officers Night Meeting Are, From Left: W. H. Eisenman, National Secretary; E. Dyble, Bardel, Inc., Chairman; and National President Donald S. Clark, California Institute of Technology

Explains Research in Metals Machining

E. J. Krabacher (Right), Cincinnati Milling Machine Co., Who Spoke on "Research and Methods of Machining Metals" at a Meeting Held by the Rochester Chapter, Is Shown With Norman Finsterwalder, Chapter Chairman

Speaker: E. J. Krabacher

Cincinnati Milling Machine Co.

Members of the **Rochester Chapter** heard E. J. Krabacher, senior research engineer, Cincinnati Milling Machine Co., speak on "Research and Methods of Machining Metals" at the first meeting of the season.

Mr. Krabacher, with the aid of slides and a high-speed movie film, described fundamental research into the nature of machining. What happens when metal is cut? and, how are chips formed and how can they be controlled? were two of the questions answered by the speaker. The three basic types of chips were described, as follows:

Type 1—The segmental chip, generally obtained when machining nonductile materials.

Type 2—The continuous chip with no built-up edge, generally obtained when machining ductile materials at high cutting speeds.

Type 3—The continuous chip with built-up edge, generally obtained when machining ductile materials at low speeds or under conditions of high friction.

Thickness of the chip depends on the shear angle developed in the material between the plane surface generated by the passage of the tip of the tool bit and the point on the outer surface where the outermost portion of the chip peels off. The shear angle in turn depends upon the physical properties of the material, the rake of the tool bit and the tool chip interface friction.

High-speed movies illustrating how the chips were formed and how the shear angle is determined were shown.

Cutting fluids were then discussed, with special mention of those containing additives which form solid films between the chip and tool and whose shear strength is lower than the material being cut. Under the conditions of cutting, these fluids form iron sulphides and iron chlorides of substantially lower shear strength than the material being cut, thus lowering the friction between tool bit and material.

The use of radioactivity to study cutting tool life was described. Radiated tools were used in a manner whereby chips were collected and the amount of wear on tool bit calculated from the amount of radioactive tool wear particles deposited on the chips. Development of this method of study resulted in great savings in time to solve machinability and tool life problems. Other problems, such as improvement of cutting fluids, are being solved by using these radioactive cutting tools—**Reported by R. E. Avery for Rochester.**

Tells Why It's Cheaper To Move Than Remove Metal At Indianapolis Meeting

Speaker: Ross C. Perry

Parker Rust Proof Co.

Ross C. Perry, manager, Cold Forming Division, Parker Rust Proof Co., presented an address entitled "It's Cheaper to Move Metal Than Remove It" at a meeting of the **Indianapolis Chapter.**

Many parts are manufactured by screw machine operations with cold extrusion. The reason for this change-over can be seen in the advantages of cold extrusion, which are as follows:

1. Cheaper base metals (because of the nature of the process low carbon steels can be used);
2. Reduction in scrap (virtually every ounce of metal present in the original slug or blank is present in the finished product);
3. Reduction or elimination of machining (cold extruded parts can be worked to such close tolerances that very little trimming or final machining is required);
4. Reduction of labor (the amount of cold work that can be accomplished in one operation and the small amount of final machining required contribute to the possibility of producing many more parts with far fewer operations);
5. Improved physical properties in final part (cold extruded parts can be made stronger than machined parts because the grain flow of the metal follows the contour of the part);
6. High production rate per dollar of capital invested;
7. Improved surface finish of part; and
8. Closer tolerances.

The success of cold extrusion in commercial applications is due to use of phosphate coatings as a separating layer and lubricant carrier. The lubricant must provide an uninterrupted film and separating layer between the tools and workpiece, even at extreme temperatures. The phosphate coating and the lubricant must be integral parts of the surface of the metal.

Surface preparation of the metal to be cold extruded is of utmost importance. A recommended cycle includes alkali cleaning, water rinse, acid pickle, cold water rinse, hot water rinse, Bonderite (phosphate coating bath), water rinse, Parcolene rinse, and Bonderlube (reactive lubricant bath).

Considering the finished product and the physical requirements of the part may aid in selecting the appropriate raw material.

Success of cold extrusion depends upon understanding by the design engineer, appreciation of factors by the tool engineer, realizing importance of coating and lubrication, and understanding between the production engineer and management.—**Reported by Dorothy Holbrook for Indianapolis.**

As an indication of the tremendous dissemination of engineering information, a compilation shows that in one year the A.S.M. collected, edited, published and distributed over *one hundred million pages* of metallurgical information.

Gives Elements of Transistor Physics At Golden Gate

Speaker: W. Shockley

Beckman Instruments, Inc.

"Elements of Transistor Physics and Signal Amplification Using Transistors" was the subject of a lecture given before the **Golden Gate Chapter** by William Shockley, director of the Shockley Semiconductor Laboratory of Beckman Instruments, Inc.

Dr. Shockley, a recent Nobel Prize winner, explained that crystals of germanium, an element of 4-valence electrons, carry current because of the presence of electronic or atomic imperfections.

Electronic imperfections may be induced when a photon of light of sufficient energy falls upon a crystal. The light energy is imparted to a valence electron. This is ejected from the electron pair bond leaving an incomplete bond or hole behind. Both of these imperfections, the excess electron and the hole, contribute to the electrical conductivity of the crystal.

W. Shockley

Thermal agitation of atoms within the crystal prevents the excess electron from becoming bound in place and it moves through the crystal, its path a function of wave mechanics with deflections resulting from the nonperiodic structure given the crystal by thermal agitation.

The perfection of the crystal is disturbed also by the presence of a hole and electrical conduction takes place in holes by the replacement process when an electron in an adjacent bond jumps into the hole in the incomplete bond. In an electric field the holes move in one direction, the electrons in the opposite. If light shines in on germanium, the pair of excess electrons and holes formed will impart conductivity to the crystal. If the light is removed, the photoconductivity dies out. The time to die away requires the presence of imperfections to catalyze the recombinations. The name given these imperfections is deathnium.

Semiconductors of interest in transistor physics are those which derive their conductivity not from light but from the presence of chemical impurities. Arsenic atoms, which have 5-valence electrons, crystallizing from a liquid of germanium and arsenic, use four of their valence electrons. The fifth electron is prevented from fitting into the crystal structure and is free to wander through the crystal as a free electron, but the covalent bonds hold the arsenic atom tightly in place. Conductivity is produced by the negative electrons.

When a gallium atom, which has 3-valence electrons, crystallizes in liquid of germanium and gallium, it does not have enough electrons to complete the bond with its germanium neighbor and steals an electron from somewhere else, leaving a hole. The hole is set free and contributes to the conductivity of the crystal.

Point-contact transistors function to amplify current by the arrangement of two conductors, insulated from one another, terminating in cat's whiskers touching one side of the germanium which rests on a metal conductor. When a signal is applied between one whisker and the conductor, an enlarged replica is obtained between the other whisker terminal and the conductor base.—**Reported by E. R. Babylon for Golden Gate.**

Cincinnatians Tour Armco

Despite inclement weather, 112 members and friends of the **Cincinnati Chapter** toured the Middletown Works of the Armco Steel Corp. during a recent meeting.

Included in the inspection trip were the blast furnace and coke oven plant, as well as the #2 open-hearth plant which features a unique system of materials handling by using elevators for moving the scrap, ore, limestone, etc., from the floor below furnace level to the charging floor.

The trip also included a visit to the hot strip mill and the continuous galvanizing Zincgrip lines.—**Reported by John H. Timmers for the Cincinnati Chapter.**

Talks on Temperature Effects on Metals

J. L. Maxwell (Left), Area Supervisor of the Parole Division, State of New York, Coffee Speaker, Francis B. Foley (Center), Consulting Metallurgist, International Nickel Co. Inc., Who Spoke on "Effect of Temperature on Metals", and E. A. March, Secretary, Talk Over Mr. Foley's Lecture at the Dinner Preceding the Meeting Held by the Syracuse Chapter

Speaker: Francis B. Foley

International Nickel Co. Inc.

Members of the **Syracuse Chapter** recently heard a lecture on the "Effect of Temperature on Metals" presented by Francis B. Foley, consulting metallurgist, International Nickel Co. Inc.

Temperature has a floor but no ceiling, Mr. Foley remarked. High-temperature properties at present are of greater importance to us. Some interesting curves showing the effect of stress versus temperature of the different alloys illustrated his point and also showed that materials containing the face centered cubic structure are most adaptable for higher temperatures, as well as for the lowest temperatures.

An interesting example was brought out in a discussion of a weldment where failure took place in the parent metal. In the analysis, tests were conducted using reduction of area as a criterion. A method of testing during rapid heating or cooling to simulate welding was used. Failures at high temperatures were intercrystalline, even on the more ductile materials where the grains had elongated. It was suggested that because of stresses set up in welding, the stiff parent metal resists some of the deformation whereas the more ductile metal relieves some of the stress. The embrittling factor in these high-chromium low-nickel alloys, where rapid cooling was not employed, was the formation of the sigma phase.

Mr. Foley also discussed the speed of deformation and the correlation between melting points and the coefficient of expansion for pure metals. The lack of oxidation resistance of molybdenum at high temperatures and the coatings being developed to protect the surface were also mentioned.—**Reported by G. Trojanowski for Syracuse.**

Pittsburgh Honors National Officers

National President Donald S. Clark Presented a Talk Entitled "Dynamic Properties of Metals" at the National Officers Night Meeting of the Pittsburgh Chapter. Past and present national officers present included, from left: Ralph Wilson, past president; Leo Hill, vice-chairman; W. H. Eisenman, national secretary; Dave Rogers, chairman; Dr. Clark, president; Harry Paxton; George Roberts, past president; and K. Van Horn, past president. (Reported by H. W. Paxton for Pittsburgh)

Worcester Members Enjoy Smorgasbord

Members of the Worcester Chapter Who Enjoyed the Annual Smorgasbord Included, From Left: Edward F. Grady, Assistant Secretary; Ralph N. S. Merritt, Jr., Secretary-Treasurer; David H. Wittemore, Technical Chairman; Robert L. Phipps, Who Spoke on the "History and Romance of Glass"; Lincoln G. Shaw, Chairman; and Walter J. Nartowt, Vice-Chairman

Describes Rebuilding of Plant

Robert Burgess, Chief Engineer, Greist Manufacturing Co., Spoke on the "Renaissance of a Metalworking Plant" at a Meeting of the New Haven Chapter. His talk covered the problems of rebuilding the Greist plant on its present site without halting production. Shown are, from left: E. P. Holtberg, chairman; Mr. Burgess; and H. O. Seeley, technical chairman

Presents Material Problems in Guided Missiles at Chicago

Speaker: G. L. Robinson
Hughes Aircraft Co.

"Material Problems in Guided Missiles" was the subject of a talk by Glenn L. Robinson, head of the materials engineering group, guided missile laboratories, Hughes Aircraft Co., at a recent meeting of the **Chicago Chapter.**

The use of AZ31 magnesium for operating temperatures of 400° F. would not normally be considered; however, because of the rather unique requirements for guided missiles, the usual design concepts are not necessarily applicable. This discussion was concerned with the selection of materials for the GAR-1 Falcon.

In the determination of the suitability of a material it is necessary to select a standard or criterion for the particular application. For the Falcon missile the philosophy is that the missile fulfill its mission.

Having accepted this, it is immaterial what shape the missile assumes during free flight provided that the aerodynamic performance is not adversely affected. Using this basic philosophy none of the usual design criteria for selecting materials, such as yield, amount of strength in a riveted joint, etc., have any significance in the design analysis. One of the most important criteria for the missile fuselage is to prevent instability failure due to creep buckling.

It can be shown for a monocoque structure that the allowable critical buckling stress is a function of the tangent modulus values that can be obtained from isochronous stress strain curves. Based on this creep buckling criterion, AZ31 magnesium is superior to all other materials for the specific design, time, temperature and stress conditions of the GAR-1 Falcon.

The determination of the requirements for a missile which encounters many phenomena in free flight is of high importance. The closer these factors can be determined, the more accurately the margins of safety can be predicted. This will in turn reflect weight saving that is one of the prime design objectives for the GAR-1 missile.

Based on the established critical creep buckling criterion, HK31 magnesium alloy is the most likely material for the higher temperature requirements of future Falcon missiles.

The talk concluded with an analysis of the materials and fabrication techniques selected in different problem areas.—**Reported by Arthur J. Laudenklos for Chicago.**

New Films

Consumable Insert Welding

A motion picture produced jointly by Electric Boat Division of General Dynamics Corp., and Arcos Corp., shows use of a special EB weld insert to join pipe by welding on one side only. Close-ups show how the process produces root pass welds with particularly smooth uniform contours on the inside of the pipe, which will minimize turbulence. Other aspects deal with the importance of the process in producing crevice-free corrosion resistant welds. This film is available for showing to local groups of technical societies from: Harold E. Snyder, Arcos Corp., 1500 South 50th St., Philadelphia 43, Pa.

IN RETROSPECT

The New Haven Chapter in January 1926 held what the chapter reporter very conservatively called a "spirited discussion" on the manufacture and heat treatment of die blocks. ALFRED J. PORTER, JR. of the Heppenstall Co. (now president of the company) was the speaker; names of many chapter members are given in the report of the ensuing discussion, which ended in strong wagers and "a kind of drawn battle—nobody satisfied, and we have a feeling that this little discussion is not yet ended".

♦ ♦ ♦

In April 1926, 43 "A.S.S.T. data sheets" had been compiled by the Recommended Practice Committee and its various subcommittees, according to a list in the *Transactions*. These sheets (actually 163 pages), when assembled into a small looseleaf notebook, constituted the original version of Metals Handbook.

♦ ♦ ♦

Two new chapters were announced in May 1926, one at Fort Wayne, Ind. and the other at Montreal, Canada. G. E. TIBBITS, factory manager of S. F. Bowser Co. (now retired), was first chairman of Fort Wayne; E. H. Soliner, assistant superintendent, International Harvester Co. was vice-chairman and A. L. CRAMP, machine foreman of International Harvester Co. (now deceased), was secretary-treasurer.

♦ ♦ ♦

Officers of the new Montreal group were ALFRED STANSFIELD, associate of the Royal School of Mines and professor of metallurgy at McGill University (deceased), chairman; C. F. PASCOE, metallurgist, Canadian Car and Foundry Co. and Canadian Steel Foundries, (a past trustee of the Society, now retired), vice-chairman; FRED H. WILLIAMS, assistant engineer of tests, Canadian National Railway, secretary-treasurer.

Defines Advances in Dollar Metallurgy

Technical Chairman Ed Witort (Right) Congratulates John P. Denny, Manager, Metallurgy and Welding Chemistry and Metallurgical Laboratory, General Electric Co., Who Presented a Talk on "Dollar Metallurgy" in Milwaukee

Speaker: John P. Denny

General Electric Co.

John P. Denny, manager, metallurgy and welding chemistry and metallurgical laboratory, General Electric Co., presented a lecture entitled "Dollar Metallurgy" at a meeting in **Milwaukee.**

Dr. Denny predicted a continued increase in the use of aluminum, probably at a rate similar to that shown in the last five years. At the present time, 2,500,000 tons of aluminum are being produced and 3,150,000 tons are planned within the next few years. The use of aluminum would have to be restricted by the manufacturers so as to be sure that it would be used only for those applications for which it is best suited. For example: It should not be used for house wiring because the contractor would probably not handle the joining of aluminum properly. This would turn public opinion against it and would probably do more harm than good. At present some of its newer uses are lamp bases, capillary tubes for refrigerators, busbars, clock movements, TV antennas, etc.

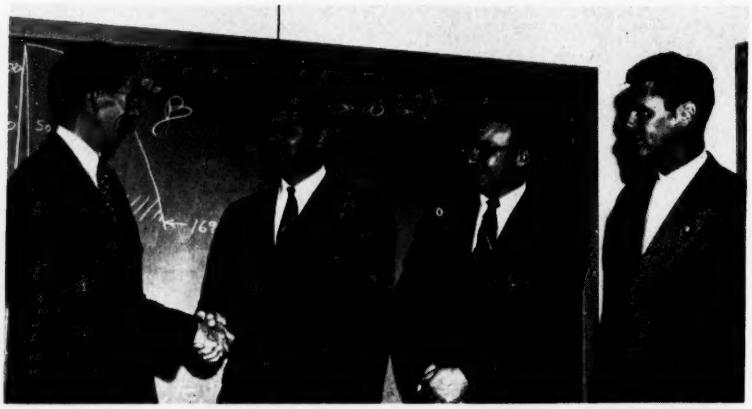
The value of automation and its profound effect on the American economy was discussed. Through automation, one can elevate the standard of living and make man more productive, thereby freeing him for other more enjoyable tasks. The General Electric Co., in Louisville, Ky., uses 45 miles of conveyor belts for the manufacture of appliances. The appliance industry is probably one of the most competitive in the field and without automation it could not survive. Careful attention to appearance, shape, color and, above all, rapid and economical fabricating techniques, must be evaluated so as to maintain a competitive position.

In the jet engine industry, however, quality and required properties are to be had at any cost, but, even now, the industry is looking around for cheaper materials. The next challenges to be met are the sound and heat barriers, and then probably the price barrier. Dr. Denny listed 11 check points to be followed in a value analysis program.

1. List qualities desired.
2. Set up a yardstick of costs.
3. Be sure all manufacturing advantages are used.
4. Carefully evaluate special problems before beginning production.
5. Carefully evaluate new materials.
6. Compare materials.
7. Study fastening problems.
8. Study safety measures required.
9. Study ease of fabrication.
10. Is it salable?
11. Be sure the material is not better than necessary.

The question and answer period which followed the lecture concerned the method of evaluating high-temperature materials. — **Reported by Donald P. Kedzie for the Milwaukee Chapter.**

Talks on Titanium at Los Alamos



Keith Mead, Sandia Corp., Spoke at the Charter Members Night Meeting of the Los Alamos Chapter on "Engineering Characteristics of Titanium". Shown are, from left: W. N. Miner, chairman; Clifford Nilsson and J. M. Taub, chapter members; and Mr. Mead. (Photo by E. M. Cramer)

Speaker: Keith Mead

Sandia Corp.

Keith Mead, Sandia Corp., addressed the **Los Alamos Chapter** on the "Engineering Characteristics of Titanium" during the Charter Members Night meeting.

In a concise and informative lecture, Mr. Mead co-ordinated and summarized the most up-to-date information on titanium. After touching on its source and production techniques, he discussed briefly the commercially available forms of the metal and the accepted fabrication and heat treating techniques, noting certain precautions which must be observed when processing this material.

Mr. Mead then compared the physical and mechanical properties and the engineering characteristics of a number of materials commonly used at elevated temperatures. It was demonstrated that presently available titanium alloys have properties which are superior to those of any other material for certain elevated-temperature usage. This fact, as well as the potential saving in weight over other materials, is encouraging air-frame manufacturers to make more use of titanium.—**Reported by H. L. Brown for Los Alamos Chapter.**

New Jersey Completes Applied Metallurgy Course

To add to their working knowledge and to sharpen their insight into fundamentals, more than 200 persons engaged in the metals and metalworking industries of New Jersey recently completed an educational lecture course in "Applied Metallurgy", sponsored by the **New Jersey Chapter.**

Conducting the lecture course in practical metallurgy for his second year was Joseph J. Connelly, research metallurgist, American Brake Shoe Co. Mr. Connelly was for six years an instructor in metallurgy at Massachusetts Institute of Technology, where he received his metallurgical degree. Besides engaging in consulting work, he has served as a metallurgist with the Nitralloy Corp. and the Atomic Energy Commission. In 1951 he joined American Brake Shoe, where he has done research on both ferrous and nonferrous alloys. He was recently promoted from metallurgist to research metallurgist.

A 12-man educational committee of the New Jersey Chapter, headed by Henry J. Chapin, also a metallurgist at the research center of American Brake Shoe, planned and arranged the lecture course. Mr. Chapin has been active in A.S.M. for about 27 years.

Designed to be of practical working value not only to metallurgists and engineers but also to those engaged in other phases of the metals industries, the lectures covered such fundamentals of metallurgy as the nature and properties of metals and alloys, methods of physical testing, crystal structure, the use of phase diagrams, production of iron and steel, production of nonferrous metals and alloys, heat treating, case hardening, casting, forging, extruding and welding.

Mr. Connelly used slides and blackboard diagrams to illustrate his lectures. The text, "Engineering Metallurgy", by Stoughton, Butts and Bounds, published by McGraw-Hill Book Company, Inc., was furnished at cost to those taking the course. Descriptive literature and technical data were furnished by such companies as U. S. Steel Corp., American Brass Co., Universal-Cyclops Steel Corp., and Crucible Steel Co. of America, among others.

Hydrogen Embrittlement And Delayed Fractures Topic of Hartford Talk

Speaker: A. R. Troiano

Case Institute of Technology

At a meeting of the **Hartford Chapter,** A. R. Troiano, head of the department of metallurgy, Case Institute of Technology, spoke on "Hydrogen Embrittlement and Delayed Fractures in High Strength Steels". His investigation into this problem was prompted by failures in high-strength steel components under relatively mild loading conditions. Hydrogen embrittlement was the suspected cause because parts were cadmium plated for corrosion protection.

SAE 4340 steel at several high-strength levels was selected for testing and notch tensile test specimens were treated with hydrogen in a standard electrolytic bath.

Dr. Troiano next showed many slides with charts and graphs, including three-dimensional colored models, which indicated the effect of hydrogen embrittlement on strength and ductility under various conditions of heating, loading and aging. His tests showed how it was possible for a hydrogen embrittled part to fail under a light load when it had previously been highly stressed without failure.

Dr. Troiano then reviewed the classical theories of hydrogen embrittlement and crack propagation in brittle materials such as glass, and tentatively proposed a new theory for hydrogen embrittlement based on his own recent work. One interesting point brought out was the fact that the failure starts below the surface of the notch. Photomicrographs were shown which illustrated this crack initiation.—**Reported by B. L. Taft for Hartford.**

Metals Review's New Look

The new "look" of *Metals Review* and its front cover will be noted by readers who have grown accustomed, over the years, to the consistent advertising on this position by Art Holden.

A. F. Holden

Art has been a continuous and constant A.S.M. fan and his use of the front and back covers of *Metals Review* has been effective for him, and helpful to *Metals Review.*

However, he is not leaving—only moving a little to permit the use of an editorial front cover. From now on—and on (we hope), you will find the A. F. Holden Co. on the *inside* front cover, and on the back cover, as usual.

Details Metallurgical Factors Which Determine Strength of Materials

Speaker: Howard Scott
Westinghouse Electric Corp.

Howard Scott, chief metallurgist, research laboratories, Westinghouse Electric Corp., presented a talk on the "Metallurgical Factors Determining the Strength of Metals" at a meeting held in **Columbus.**

The metallurgist has a difficult job in industry. He must select metals and treatments for high-strength applications, often with inadequate information, and needs to know all the major factors governing flow and fracture.

Tensile properties of metals are most important. The interpretation of available data is reasonably satisfactory but the reporting of values is inadequate. Information essential to the design engineer is (a) yield strength (0.01 or 0.2% strain); (b) ultimate strength, including true ultimate (drop in load), and fracture strength (load rising); and (c) uniform elongation. The metallurgist also has special interest in true fracture strength, reduction in area (uniform and necking), and fracture surface characteristics.

The evaluation of effects of metallurgical variables is severly complicated by a large number of active impurities and the need for exacting control of structure.

Face-centered cubic metals, such as annealed nickel and annealed alpha brass, give shear fractures, while body-centered cubic materials may show cleavage fractures. Grain-boundary fractures should be assiduously avoided.

In annealed alpha brass the uniform elongation decreases moderately by varying the grain size from A.S.T.M. No. 1 to 9, while the yield, ultimate and fatigue strengths double in value. This practical example illustrates the behavior of many other metals.

A stable austenitic alloy having a low drop in yield strength between 75 and 800° F. was sought. Its yield strength at 800° F. is 65% of that at 75° F. The necking component is independent of grain size and is reduced by an increase in the test temperature, while there is a slight drop in uniform reduction of area with increase in test temperature.

Body-centered cubic metals have the same relationships as face-centered cubic metals, plus complications. Ductility is a major concern and limits increase in strength, which is determined by fracture.

Pure molybdenum is an ideal metal for testing research. At 100° C. molybdenum shows a shear fracture and 77% reduction of area, at 20° C. a cleavage fracture and 70% reduction of area, and at −74° C. a cleavage fracture and zero ductility. The fracture appearance and ductility define the transition range precisely. Grain refinement improves the ductility. Grain coarsening lowers the cleavage fracture strength and raises the transition range limits. Pure molybdenum shows cleavage fractures while impure molybdenum shows grain-boundary breaks.

Ingot iron and mild steel at −195° C. show significant increases in cleavage fracture strength, lower yield point, and reduction in area as the grain size becomes smaller. The values level off at No. 7 to 8 grain size. This is a generality for face-centered cubic and body-centered cubic materials.

Pure iron-oxygen alloys give maximum impact values up to 0.004% oxygen. Additional amounts of oxygen and nitrogen promote grain-boundary fracture and embrittlement.

Carbon is also an embrittling agent and its effect is reduced by grain refinement in pure iron-carbon alloys (up to 0.12%). The yield strength is doubled by grain refinement.

Carbon is an embrittling agent in slow cooled steels but this effect is moderated by manganese. In normalized steels containing 1.0% manganese and 0.22 to 0.30% silicon the tensile properties vary widely with varying carbon content. From 0 to 0.70% carbon the ultimate tensile strength rises rapidly and linearly in an inverse relation to ductility. The yield strength reaches a maximum at approximately 0.30% carbon.

The effects of alloying are important in steels for large forgings. Nickel and manganese lower the Charpy V—notch transistion temperature and lower the Ac_1 and Ar_1. Silicon and chromium have little effect. Manganese and chromium raise the pearlite content while nickel and silicon have little effect. High sulphur induces more banding which is bad for transverse loading. Sulphur and phosphorus should be kept as low as possible, particularly in large forgings.—**Reported by Robert S. Corder for Columbus Chapter.**

Outlines Nuclear Energy Applications

Donald Eldred, General Electric Co., Presented a Talk on "Industrial Applications of Atomic Energy" at a Meeting Held by the Texas Chapter. Shown are, from left: Curtis L. Horn, vice-chairman; Mr. Eldred; and Russell F. Goff, chairman. (Photograph by Lee Dolan for Texas Chapter)

Speaker: Donald Eldred
General Electric Co.

Donald Eldred spoke to the **Texas Chapter** on "Industrial Applications of Nuclear Energy". Mr. Eldred is associated with the General Electric Co. as sales manager for special reactors and components.

A brief discussion of basic nuclear phenomenon was followed by a discussion of the various research reactors, including their advantages and disadvantages.

A film entitled "A-For Atom", which presented in understandable terms the fundamentals of nuclear energy, was shown. The discussion included description of the alpha, beta and gamma particles and concluded by discussing some of the commonly used applications of nuclear energy. Examples of these applications included measure of wear on piston rings, measure of liquid density in an autoclave, and measure of die wear.

Nuclear reactor activity at General Electric and other companies was discussed and it was indicated that there are at present about 120 reactors under construction or contemplated.

Various types of reactors, including the swimming pool reactor, nuclear test reactor and heavy water reactor were described. The swimming pool reactor is so named for the pool of water which is associated with it for cooling purposes, as a moderator and as a shield.

Some applications of research reactors are training, short-lived isotope production and medical research.

Application of reactors for power production was outlined. Presently high cost is an important restriction in this field. Perhaps by 1960 or 1970 this disadvantage will be overcome. Future uses may include large aircraft and ships.—**Reported by Robert C. Anderson for the Texas Chapter.**

Meet Your Chapter Chairman

OTTAWA VALLEY

BRUCE F. RICHARDSON was born in Toronto and received his B.A.Sc. degree from the University of Toronto. Prior to World War II, he was in sales, light metals and hydraulic machinery being his two main occupations during that period. During the War he served as an aircrew member in the R.C.A.F. He was research metallurgist for the Steel Castings Institute before accepting his present position as director of research with Quebec Metallurgical Industries Ltd.

Bruce is married and has three children. As well as technical society affiliations, he has an active interest in church management and Boy Scout work. He was program committee chairman and vice-chairman prior to becoming chairman of the Ottawa Valley Chapter this year. He is a sail boat enthusiast, but presently has to satisfy this desire in a power boat, due to lack of facilities for sailing in his area.

NEW JERSEY

JIM HAUPTLY is a native of Pottsville, Pa. Following completion of primary schooling in Philadelphia, he attended Manhattan College and Stevens Institute of Technology. Immediately after college, he went to work as a laboratory technician for the U. S. Department of Agriculture.

After service in the Army, he joined Joseph T. Ryerson & Son in the merchandise department, progressing from there to inside sales, alloy sales, manager of alloy sales, and to his present position as manager of inside sales.

Father of three boys, Mr. Hauptly has been active in civic affairs, serving on town planning committees and other civic functions.

His principal outside interests lie in working with boys through scouting, the Lions Club and various juvenile groups.

SOUTHERN TIER

T. F. SHARP was born in Detroit, and received a B. S. in metallurgical engineering from University of Michigan in 1943. After graduation he joined the Chrysler Corp. at the Dodge Chicago plant, where he was employed in production heat treating and machinability as a metallurgical project engineer.

He returned from service with the Aerology Branch of the U. S. Navy to take a position as research engineer under Walter E. Jominy at Chrysler Central Engineering in Detroit.

In 1949 he joined the Detroit Gear Division of Borg-Warner as assistant chief metallurgist, and was later promoted to assistant to the vice-president of engineering. During this period he lectured before chapters of the A.S.M. on the metallurgy of the Studebaker automatic transmission.

Accepting a promotion within the Borg-Warner family of companies, Mr. Sharp moved to "The Garden Spot of the East", Ithaca, N. Y., in 1952, where he became chief metallurgist of the Morse Chain Co., and in 1955 attained his present position as assistant chief engineer.

Ted is married and lives near Ithaca in the Village of Cayuga Heights where he is a trustee and acting mayor. Cruising on Lake Cayuga with his wife and two children in their new boat is his chief spare-time recreation. He follows University of Michigan football with undying loyalty.

PUGET SOUND

DAVID R. MESLANG, a native of San Francisco, received his degree from the University of California, where he was active in swimming, soccer and water polo. His first job was with Crucible Steel Co. of America, and he is presently manager of sales and of the Seattle and Portland warehouses for Crucible.

Dave is married and has two children. He is a member of the Northwest Mining Association and the American Steel Warehouse Association, and a veteran of the Corps of Engineers, U. S. Army. His hobbies are golf, fishing, water skiing and boating.

KANSAS CITY

FRED E. FITZGERALD, chairman of the Kansas City Chapter, is red headed and as Irish looking as his name implies. He was born in Portland, Ore., in 1915, and attended grade school and high school in Minneapolis, Minn., where he was a star football player.

His first job after high school was driving a delivery truck. Prior to World War II he sold and serviced carbonated beverage machines and had some factory experience with Ford Motor Co. During World War II he served in the Navy in the E.T.O. in aviation submarine patrol both on PBY's and blimps.

After the war he returned to Minneapolis as manager of a sheet metal fabricating shop producing grain handling equipment.

In the fall of 1950 Fred joined Metallurgical Inc., a commercial heat treating shop. In 1951 he was transferred to Kansas City where he opened up a branch plant for Metallurgical Inc., for which he now serves as general manager.

In 1951 Fred married Joyce Anderson of Canada and they have a daughter, Laurie.

Fred joined the Kansas City Chapter in 1952 and has served as entertainment chairman, vice-chairman and on the executive committee prior to his election as chairman.

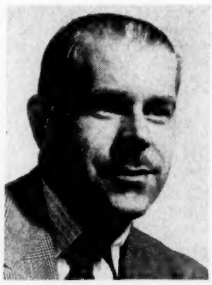
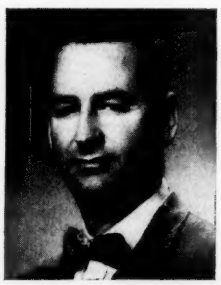
BIRMINGHAM

SANFORD P. ENSLEN, Jr., assistant quality control metallurgist, T.C.I. Division, sheet mill, U. S. Steel Corp., was born in Springfield, Mo., and educated in the public schools in Springfield and in Birmingham, Ala. He received his degree from Birmingham Southern and the University of Alabama, the latter through extension courses.

Mr. Enslen was active in high school and college football as well as track and baseball. His first job was as an inspector of malleable iron pipe fittings.

Sanford is married and has two children, a boy 14 and a girl 11. His outside interests include baseball and photography.

T. F. Sharp *J. J. Hauptly* *S. P. Enslen* *B. Richardson* *D. R. Meslang*

CHAPTER MEETING CALENDAR

Akron	**Feb. 20**	Sanginiti's	**H. F. Reid**	Electrode Coatings
Atlanta	**Feb. 4**	Atlantic Steel Co.	**Panel**	Joint Meeting With A.S.T.E.
Baltimore	**Feb. 18**	Engineers Club	**R. C. Werner**	Applications of Liquid Metals in Industry
Birmingham	**Feb. 5**	Gulas Restaurant	**J. W. W. Sullivan**	Statistical Methods in Steel Technology
Boston	**Feb. 1**	M.I.T. Faculty Club	**H. A. Wilhelm**	Metallurgy of Atomic Energy
British Columbia	**Feb. 21**		**D. S. Clark**	Propagation of Plastic Strain in Metals
Buffalo	**Feb. 14**	Mann's 300 Club	**D. S. Clark**	Yield Phenomenon in Low Carbon Steel
Calumet	**Feb. 12**	Phil Smidt's	**Social**	Ladies Night
Canton-Massillon	**Feb. 5**	Mergus Restaurant	**C. H. Lorig**	Fruits of Metallurgical Research
Carolinas	**Feb. 21**	Salisbury	**Charles Rice**	Jewelry Making—Ladies Night
Chattanooga	**Feb. 19**	Maypole Restaurant	**F. La Que**	Corrosion
Chicago	**Feb. 11**	Furniture Club	**R. F. Thomson**	Durability of Carburized Gases
Chicago-Western	**Feb. 18**	Spinning Wheel	**M. E. Merchant**	Industrial Uses of Radioisotopes
Cincinnati	**Feb. 14**	Engineering Society	**R. F. Thomson**	Physical Metallurgy and Residual Stress
Cleveland	**Feb. 4**	Hotel Hollenden	**R. Mattson**	Fatigue and Residual Stresses
Columbia Basin	**Feb. 19**		**D. S. Clark**	Plastic Strain in Metals
Columbus	**Feb. 6**	Broad St. Church	**H. R. Clauser**	New Developments in Materials Engineering
Dayton	**Feb. 13**	Engineering Club	**L. F. Lipper**	Stainless Steel in the Modern Home
Detroit	**Feb. 11**	Elmwood Casino	**D. S. Clark**	Dynamic Properties of Metals
East New York	**Feb. 12**	Panetta's	**J. F. Elliott**	New Trends in Steelmaking
Golden Gate	**Feb. 11**	Spenger's Fish Grotto	**R. A. Schatzel**	Copper
Indianpolis	**Feb. 18**	Village Inn	**H. H. Johnson**	Practical Aspects of Hydrogen Embrittlement
Jackson	**Feb. 12**		**D. S. Clark**	National Officers Night
Kansas City	**Feb. 20**	Aladdin Hotel	**Paul Bowen**	Application of Radioactive Tracers in Metallurgy
Lehigh Valley	**Feb. 1**	Hotel Traylor	**W. S. Pellini**	Brittle Fracture
Los Alamos	**Feb. 18**		**W. D. Manly**	Corrosion by Liquid Metals
Los Angeles	**Feb. 28**	Rodger Young Auditorium	**L. L. Gilbert**	Materials for Rocket Engine Development
Louisville	**Feb. 5**	White Cottage	**J. D. Nisbet**	Vacuum Melting
Mahoning Valley	**Feb. 9**	V.F.W.	**Social**	Valentine Party
Milwaukee	**Feb. 19**		**N. B. Jones**	Typical Industrial Furnace Heat Transfer Relationships
Muncie	**Feb. 12**	Student Center	**K. F. Charter**	Plastics Versus Metals
New Jersey	**Feb. 18**	Essex House	**J. S. Alter**	Production Metallurgy of Sheet Steel
New Orleans	**Feb. 6**		**J. W. Nee**	Protective Coatings
New York	**Feb. 15**	Hotel Delmonico	**Social**	Valentine Dinner-Dance
NE Pennsylvania	**Feb. 14**	Country Club	**J. E. King**	Cold Extrusion of Steel
NW Pennsylvania	**Feb. 21**	Franklin	**Plant Visit**	Joy Manufacturing Co.
Notre Dame	**Feb. 13**		**R. L. Mattson**	Residual Stress
Oak Ridge	**Feb. 20**	Oak Terrace Restaurant	**C. H. Loring**	Fruits of Metallurgical Research
Ontario	**Feb. 1**	Toronto	**S. Epstein**	Aging and Embrittlement of Mild Steel
Oregon	**Feb. 25**	Congress Hotel	**D. S. Clark**	National Officers Night
Ottawa Valley	**Feb. 12**		**Social**	Ladies Night
Peoria	**Feb. 11**	New American Legion Hall	**F. B. Rote**	Malleable Base Spheroidal Iron
Philadelphia	**Feb. 22**	Engineers Club	**H. T. Hallowell, Jr.**	Operations Research
Philadelphia Jr.'s	**Feb. 11**	Engineers Club	**Social**	Ladies Night
Phoenix	**Feb. 19**		**W. D. Manly**	Reactor Materials and Technology
Pittsburgh	**Feb. 14**	Gateway Plaza	**E. C. Smith**	Carnegie Lecture—Alloys Steels in Defense
Puget Sound	**Feb. 20**	Engineers Club	**D. S. Clark**	National Officers Night
Purdue	**Feb. 19**	Memorial Union	**W. T. Bean**	Strain Measurement
Rhode Island	**Feb. 6**	Johnson's Hummocks Grill	**F. G. Tatnall**	Strain Gages
Rochester	**Feb. 11**	Chamber of Commerce	**Loren Olmsteads and L. M. Hall**	The St. Lawrence Seaway
Rockford	**Feb. 27**	Faust Hotel	**R. R. Tatnall**	Springs
Rocky Mt.	**Feb. 15**	Oxford Hotel	**E. E. Bishop**	Art of Spark Testing
St. Louis	**Feb. 15**	Hotel Congress	**L. V. Klaybor**	Toolsteels—Heat Treatment
Savannah River	**Feb. 14**	Tinnerman's Lodge	**J. T. Ferri**	Machine Shop Practice
Southern Tier	**Feb. 11**	Pierce's Restaurant	**E. H. Phelps**	Corrosion
Springfield	**Feb. 20**		**Tour**	Springfield Trade School
Texas	**Feb. 5**	Ben Milam Hotel	**S. Hoyt**	Impact Testing of Metals
Tri-City	**Feb. 1**	Rock Island Arsenal	**K. L. Fetters**	Steelmaking Production or Research
Vancouver	**Feb. 22**		**D. S. Clark**	National Officers Night
Washington	**Feb. 11**		**M. A. Hunter**	Burgess Lecture—Titanium
West Michigan	**Feb. 18**	Morton House	**A. F. Holden**	Austempering and Martempering
West Ontario	**Feb. 8**	London		Die Castings
Wilmington	**Feb. 13**	Du Pont Country Club	**R. F. Koenig**	Selecting Materials for Liquid Metal Service
Worcester	**Feb. 13**	Hickory House	**W. F. Whitty**	Stampings
York	**Feb. 13**	York		Metallurgical Research at General Motors Corp.

Lay Groundwork for Western Metal Show

National President Donald S. Clark (Left), and National Secretary William H. Eisenman, Examine Program Plans of William V. Ward, Technical Program Chairman for the 10th Western Metal Congress A. S. M. Sessions

The Tenth Western Metal Exposition, to be held from Mar. 25 through Mar. 29, 1957, will fill the Pan-Pacific Auditorium and three huge canvas pavilions in Los Angeles. This will be the first time that the Western Metal Show has occupied a third pavilion; the last Show in Los Angeles required only the auditorium and two canvas annexes.

The Tenth Western Metal Congress, to be held on the same dates in Los Angeles' Ambassador Hotel, will include technical sessions by the American Society for Metals, the Los Angeles Section of the American Welding Society, the Society for Nondestructive Testing and the American Institute of Mining, Metallurgical and Petroleum Engineers.

A Titanium Conference, similar to the one given at university level two years ago in cooperation with New York University but of greater scope, will be sponsored by the Metals Engineering Institute during the Congress. Cooperation in presenting the Conference has been promised by the Titanium Metals Laboratory of Battelle Memorial Institute, and Walter L. Finlay, vice-president, Rem-Cru Titanium, Inc.

Panel on Metallurgical Processes in Industry

A recent meeting of the **Kansas City Chapter** was in the form of a panel discussion on "Metallurgical Processes in Industry". The moderator was Jim Cametti, Westinghouse Electric Corp.

Members of the panel were: Ed Cornelius, supervisor of inspection, Fairbanks-Morse; Herb DeWitt, president, Chromium, Inc.; Vernon Hurst, chief process engineering, Vendo, Inc.; Art McGee, assistant chief process engineering, Bendix Aviation; Fred McCoy, chief metallurgist, Sheffield Steel Co.; and Ken Rose, professor, Kansas University.

The meeting was open to the public with special invitations to smaller industries to bring their everyday metallurgical problems for discussion in an open forum meeting. Several guests were present and availed themselves to the panel's helpful directions as to possible solutions to their problems.

The field of questions and answers ranged from precision castings, weldings, platings and chemical finishings to fabrication and heat treating.

One of the most pertinent topics of discussion was the shortage of trained metallurgical personnel in the Kansas City Area. A general survey of the Chapter's action, allied with A.S.M. national activities, in its drive to interest more young people in the field of metallurgy was outlined by Fred Fitzgerald, chairman of the Chapter. Ken Rose of Kansas University indicated that, for the present at least, there would be no rapid relief to this shortage. This year in the school of metallurgy—"No seniors—very few juniors —and a fair crop of sophomores".

Dr. Rose mentioned some of the things being done or planned to correct this problem including a course in metallurgical engineering instituted at the University of Kansas City, sponsored by the Kansas City Chapter, information films to introduce high-school students to the field, sponsored by A.S.M., technical night school, planned by Chamber of Commerce within the next three years, and fellowships for advanced study in metallurgy, sponsored by A.S.M. —**Reported by Lowell M. Noblet for Kansas City.**

Technical Papers Invited for A.S.M. Transactions

The Transactions Committee of the A.S.M. is now receiving technical papers for consideration for publication in the 1958 Transactions and possible presentation before the next national meeting of the Society to be held in Chicago, Nov. 4 to 8, 1957.

Many of the papers approved by the Committee will be scheduled for presentation on the technical program of the 39th National Metal Congress and Exposition and the 2nd World Metallurgical Congress.

Papers may be submitted any time up to Apr. 15, 1957, for consideration for presentation at this convention. The selection of approved papers for the convention technical program will be made early in May 1957. Manuscripts may be submitted any time during the year and upon acceptance by the Transactions Committee will be processed immediately for preprinting. All papers accepted will be preprinted and made available to any members of the Society requesting them. However, the printing of an accepted paper does not necessarily infer that it will be presented at the convention. Under a new plan of the Society, preprinting of accepted papers will be done quarterly. Notification of their availability will be published in *Metals Review*.

Manuscripts in triplicate, plus one set of unmounted photographs and original tracings, should be sent to the attention of Ray T. Bayless, assistant secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Should it be your intention to submit a paper, please notify A.S.M. A copy of the booklet entitled "Suggestions to Authors in the Preparation of Technical Papers" will be gladly forwarded. This booklet may help considerably in the preparation of line drawings and illustrations.

Ohio State Student Gets Scholarship

Jim Clum (Center), Ohio State University Metallurgical Student, Is Shown Being Presented a Scholarship Award by Mars Fontana (Left), Head of the Department of Metallurgical Engineering, While Gerry Wood, Vice-Chairman of the Columbus Chapter Looks On. (Reported by R. Ernest Christin)

Toledo Members Given Data on Metal Ceramics

Speaker: T. F. Frangos

Haynes Stellite Co.

Toledo Chapter members heard a talk on "Metal Ceramics" by T. F. Frangos, sales engineer, Haynes Stellite Co., at a recent meeting.

The discussion was centered on the characteristics of various types of cermets, their fabrication, and typical applications.

The biggest efforts with cermets have been directed towards finding a material that would permit gas turbine engine designers to design for higher temperatures and stresses than now permitted by superalloys. The metal and ceramic combinations were first investigated in the hopes that a combination of the two would retain the best properties of each of the constituents (i.e., ductility of the metals and higher temperature properties of the ceramics), and yield materials suitable for gas turbine blading and other components to operate under stress at over 1800° F. While superior stress-rupture properties have been obtained from various combinations as well as suitable oxidation resistance, the end results universally include unsatisfactory impact strength. Until suitable impact strength and ductility are achieved, cermets will not find extensive use in gas turbine applications. A possible exception to this lies in small turbine wheels where impact problems are not encountered.

Meanwhile, a variety of other applications are promising, such as the use of cermets in contact with molten metals (brass, bronze, aluminum, etc.) or as high-temperature components where some of the metallic characteristics, such as thermal and electrical conductivity and thermal shock resistance, are required.

Cermets are classified generally as carbide-base, boride-base, silicon-base and oxide-base. The carbide and boride-base materials are usually easily wet by the metal binders, they have high thermal and electrical conductivity, they form good bonds between the metal and ceramic phases and have high refractoriness. The strength and impact resistance characteristics are influenced by the metal binder content and vary inversely to each other. The titanium carbide-base cermets have received the greatest emphasis, although the chromium boride-base with chromium molybdenum binder shows promise for high-stress and high-temperature parts.

The oxide-base cermets have low wetting characteristics and appear more suitable for lower stress, high-temperature applications, especially where oxidation is a problem. Tests are currently being conducted in a wide variety of applications where erosion, abrasion, frictional wear, oxidation and moderate stresses are involved. Typical uses are as thermocouple protection tubes, shaft seals, furnace hardware, and control devices such as flame guardian rods. **—Reported by R. E. Hanslip for Toledo Chapter.**

Professor Visits Russia

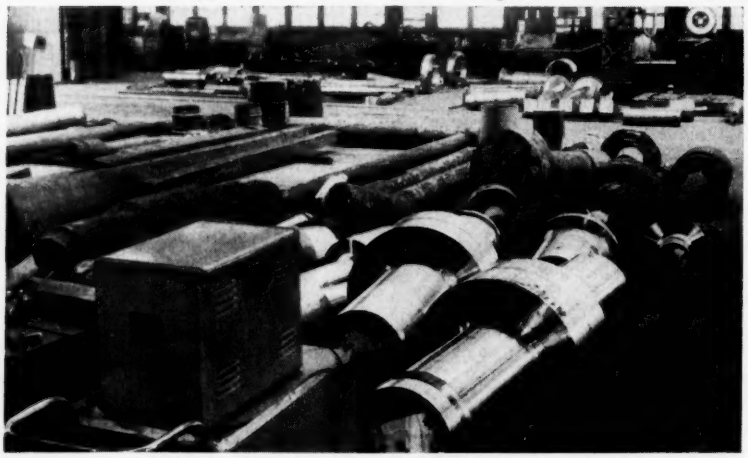
John P. Nielsen, department of metallurgy, New York University, and past chairman of the New York Chapter, recently returned from a month's stay in the Soviet Union.

Dr. Nielsen went to Russia on Nov. 4 at the invitation of the Soviet Academy of Sciences and with the approval of the U. S. Department of State. He was to attend an atomic energy conference, visit plants, lecture, and explore informally the question of the exchange of students and professors. Dr. Nielsen is believed to be the first American engineering professor both to lecture and attend a technical meeting in the Soviet Union since World War II.

Yale Student Receives Scholarship

Nicholas G. Error, Jr. (Left), Metallurgy Student at Yale University, Is Shown During a Recent Meeting of the New Haven Chapter Being Presented With an A.S.M. Scholarship Certificate by William D. Robertson, Department of Metallurgy, Yale University. (Reported by James L. Baker)

Schaefer Heads Pencoyd Steel



General View of Pencoyd Shipping Area

A. O. Schaefer, immediate past national president of the American Society for Metals, heads a group that has purchased what has been, up to now, the Fairmount Steel Corp. in Philadelphia. Under new ownership, the firm becomes the Pencoyd Steel & Forge Corp., with Mr. Schaefer as president, specializing in high quality open die steel forgings. Almost every grade of steel is available.

Pencoyd, a name with considerable background in the steel industry, occupies 7½ acres of ground directly on the banks of the Schuylkill River. It is a completely integrated steel plant which is said to be unique among forging companies of this size. It has a 10-ton electric furnace, a 1400-ton forging press, complete with soaking pits, heat treat facilities and machine shop. The company has been making forgings for rotors, steam turbines, pinions, rolls, shafting, extrusion press parts and a variety of forgings of this nature.

Associated with Ad Schaefer, who was formerly with Heppenstall-Midvale Co., is Fred Stackel as vice president; he has been assistant to the president, J. G. Brill Co. Secretary-treasurer of Pencoyd is J. J. Higgins, formerly of Southern Steamship Co., works manager is E. J. Keeffe, formerly of Crucible Steel Co. of America, and chief metallurgist is Edward Spring, formerly chief metallurgist at Henry Disston & Sons.

A. O. Schaefer

Titanium Conference Program Plans Shape Up

Reservations are mounting as the A.S.M. Metals Engineering Institute puts the finishing touches on its Titanium Conference program scheduled for Mar. 25 to 29 in Los Angeles. These five days will be packed with the most comprehensive and practical lecture and panel sessions on titanium. Outstanding authorities in the field will talk on the following topics:

Monday

Design Criteria in Airframes, by S. R. Carpenter, Convair

Uses in Missiles, by T. Mociun, North American Aviation

Titanium in Jet Engines (Speaker to be announced).

Uses in Army and Navy Applications, by A. F. Jones, Watertown Arsenal

Civilian Uses, by L. J. Barron, E. I. du Pont de Nemours & Co.

Stress Relief and Annealing (Speaker to be announced).

Pickling and Degreasing, by representative from Mallory-Sharon Corp.

Salt Bath Descaling, by representative from Mallory-Sharon Corp.

Tuesday

Blanking and Forming of Titanium Sheet, by W. A. Mays and G. J. Matey, North American Aviation

Forming of Extrusions and Bars of Titanium (Speaker to be announced).

Forming of Tubular Stock, by T. M. Krebs, Babcock & Wilcox Co.

Panel on Forming

Wednesday

Milling of Titanium (Speaker to be announced).

Drilling and Tapping (Speaker to be announced).

Single Point Cutting, by S. H. Flanagan, Convair

Grinding, by L. D. Hays, Thompson Products, Inc.

Chemmilling, by Manuel Sanz, North American Aviation

Panel on Machining, by L. B. Stearns, S. H. Flanagan, L. D. Hays, and Manuel Sanz, U. S. Chemical Milling Corp.

Thursday

Arc Welding and Joining of Titanium (Speaker to be announced).

Resistance Welding (Speaker to be announced).

Brazing and Soldering, by Harry Schwartzbart, Armour Research Foundation

Titanium Rivets and Screws, by Harry Brenner, Olympic Screw & Rivet

Titanium Bolts, by J. A. Vam Hamersweld, Northrop Aircraft

Friday

Sources and Influences of Impurities, by D. H. Barbour, Electro Metallurgical Co.

Limitations of Titanium Castings, by A. H. Roberson, U. S. Bureau of Mines

Limitations of Titanium Powder Metallurgy, by A. D. Schwope, Clevite Research Center

Titanium Forgings, by J. J. Russ, Steel Improvement & Forge Co.

Panel on Research in Progress, by N. E. Promisel, Bureau of Aeronautics and representatives from various titanium producers.

The panels on forming, machining, research on titanium will give every metallurgist and engineer a chance to put his pet problem up for discussion. As a special feature, manuscripts or abstracts of the talks presented will be distributed to registrants at the conclusion of the Conference, together with the ASM-MEI Course on Titanium presently being edited by Walter Finlay, vice-president and manager of research, Rem-Cru Titanium Corp. The registration fee is $125.00, which includes daily lunches and course materials.

IMPORTANT MEETINGS *for February*

Feb. 5-7 Society of the Plastics Industry, Inc. Reinforced Plastics Division, 12th Annual Technical and Management Conference, Edgewater Beach Hotel, Chicago. (565 Fifth Ave., New York 17, N. Y.)

Feb. 11-12 Scientific Apparatus Makers Association. Laboratory Quality Control and Research Resource Conference, Michigan State University, East Lansing. (K. Andersen, Executive Vice-President S.A.M.A., 20 North Wacker Drive, Chicago 6, Ill.)

Feb. 24-28 American Institute of Mining, Metallurgical and Petroleum Engineers, Inc. Annual Meeting, Hotels Roosevelt and Jung, New Orleans, La. (Ernest Kirkendall, Secretary, A.I.M.E., 29 West 39th St., New York 18, N. Y.)

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared by the Technical Information Division of Battelle Memorial Institute, Columbus, Ohio

General Metallurgy

1-A. ALAR 00.12 Aluminum Casting Alloy. *Alloy Digest,* no. Al-45, Nov. 1956.

Composition, physical constants, mechanical properties of castings, castability, weldability and corrosion resistance. (A general; Al, 5)

2-A. Bisbo Pearlitic Malleable Iron. *Alloy Digest,* no. CI-17, Nov. 1956.

Composition, properties, heat treatment and machinability. (A general; CI)

3-A. Ni-Vee Type E Leaded Bearing Bronze. *Alloy Digest,* no. Cu-44, Nov. 1956.

Composition, mechanical properties, machinability, castability, corrosion resistance and general characteristics. (A general; Cu)

4-A. Eclipsaloy 517 Magnesium Sand Casting Alloy. *Alloy Digest,* no. Mg-29, Nov. 1956.

Composition, casting properties, machinability, weldabilty and corrosion resistance. (A general; Mg)

5-A. Hastelloy Alloy-D Corroson Resisting Alloy. *Alloy Digest,* no. Ni-29, Nov. 1956.

Composition, physical constants, mechanical properties, weldability and corrosion resistance. (A general; Ni-f)

6-A. AISI 3130 Nickel-Chromium Alloy Steel. *Alloy Digest,* no. SA-50, Nov. 1956.

Composition, mechanical properties, heat treatment and machinability. (A general; AY)

7-A. Armco 22-4-9 Corrosion and Heat Resistant Steel. *Alloy Digest,* no. SS-49, Nov. 1956.

Composition, physical constants, mechanical properties, heat treatment, workability, pickling and general characteristics. (A general; SS)

8-A. Vanadium Type "D" Chromium-Vanadium Tool Steel, Type L2. *Alloy Digest,* no. TS-52, Nov. 1956.

Composition, physical constants, mechanical properties, heat treatment, machinability and general characteristics. (A general; TS)

9-A. Thermenol—a New "Soft" Magnetic Alloy. J. F. Nachman and W. J. Buehler. *Electrical Manufacturing,* v. 58, Nov. 1956, p. 140-142, 145, 354.

Nonstrategic ternary system of iron-aluminum-molybdenum is under heavy investigation as a high-temperature structural material, might become a replacement for critical nickel or cobalt magnetic alloys. (A general; SG-p, SG-h)

10-A. (Spanish.) **Technical Documentation and International Cooperation. Application to Metal Joining.** Lise Blosset. *Tecnica Metalurgica,* v. 12, no. 105, May-June 1956, p. 82-92.

Various factors of documentation studied and applied to the organization of information in a definite industry. Improvements of methods in the welding field. Other special techniques. (A14, K general)

11-A. Zinc: Properties and Uses in Modern Industry. *Canadian Mining and Metallurgical Bulletin,* v. 49, no. 535, Nov. 1956, p. 742-754; *Canadian Institute of Mining and Metallurgy, Transactions,* v. 59, 1956, p. 410-422.

A series of seven papers on die casting, zinc rolling, continuous galvanizing of steel band, zinc grades and specifications, alloys and corrosion, research and development, and general trends and economics. (A general; Zn)

12-A. Titanium Moves Into Process Equipment. G. T. Bedford, W. J. Weeks and A. G. Caterson. *Chemical Engineering,* v. 63, Dec. 1956, p. 238 + 5 pages.

Economics and availability of titanium, physical and mechanical properties, fabricating, corrosion resistance. (A general; Ti)

13-A. Nuclear Irradiation and Radioisotopes in Metal Research. Massoud T. Simnad. *International Journal of Applied Radiation and Isotopes,* v. 1, no. 3, Nov. 1956, p. 145-171.

Review of research using nuclear irradiation in detecting minute quantities of impurities or minor constituents and in studying metal structure; also, use of radioisotopes in studies of segregation, friction, vapor deposition, vapor pressure, slag-metal reactions, electrolytic action on metal surfaces, diffusion and oxidation. (A general, 14-13, 2-15)

Starting with this issue of Metals Review *the subject coding at the end of the annotations will refer to the revised edition of the ASM-SLA Metallurgical Literature Classification. The revision is currently being completed by the A.S.M. Committee on Literature Classification, and will be published in full in late spring or early summer. A schedule of the principal headings in the revised version will be published in the February issue.*

14-A. Aluminium in the Economy of the United Kingdom. W. J. Thomas. *Light Metals,* v. 19, Nov. 1956, p. 344-347.

Production, consumption and uses. (A4p; Al)

15-A. Titanium Design Notes. *Magnesium,* Nov. 1956, p. 10-15.

Properties, formability, welding characteristics, corrosion resistance. (A general; Ti)

16-A. A Dictionary of Metallurgy. A. D. Merriman and J. S. Bowden. *Metal Treatment and Drop Forging,* v. 23, Nov. 1956, p. 457-464.

From "tophat" to "ultimate strength". (To be continued.) (A general, 11-17)

17-A. (French.) **Present and Possible Future Uses of Metallic Molybdenum.** J. Fabry and P. Gousseland. *SIM-Documentation Métallurgique,* 1956, no. 27, July-Sept. 1956, p. 223-233.

Chemical properties of metallic molybdenum, especially its behavior in the presence of corrosive agents. Possible applications in remote control engines and nuclear reactors. (A general, R general; Mo, 18-2)

18-A. (German.) **Malleable Cast Iron.** F. Roll. *VDI Zeitschrift,* v. 98, no. 31, Nov. 1956, p. 1765-1767.

Melting and molding techniques. The alloy tolerances for a satisfactory specimen. New uses from welding this material with steel. (A general; CI)

19-A. (Russian.) **Reducing Production Costs of Electric Steel Melting.** A. F. Kablukovskii. *Metallurg,* no. 10, Oct. 1956, p. 14-17.

A commercial process was studied to improve furnace production, quality and output of metal, the consumption of electric energy. (A4s, D5; ST)

20-A. The First Half-Century of Electric Furnace Steel Making. S. B. Casey, Jr. *Journal of Metals,* v. 8, Dec. 1956, p. 1637-1641.

Evolution of furnace design, development of electrical equipment, other developments cutting down time and speeding operation, expectations from the second half century. (A2, D5; ST)

21-A. The Cyclical Movement of Steel Scrap Prices. Chapin Hoskins. *Journal of Metals,* v. 8, Dec. 1956, p. 1651-1653.

For over 50 years scrap steel price has risen and fallen cyclically. Cycles can be effectively measured in terms of rate of change and are related to cycles in other prices and business activity. (A4q; ST, AD-b)

22-A. (Book.) **Chemical Engineering Practice. v. II. Solid State.** Herbert W. Cremer and Trefor Davies, editors. 632 p. 1956. Academic Press, 125 E. 23rd St., New York 10, N. Y.

Fundamental concepts of matter

in the solid state, properties of metals, alloys, plastics and glasses, corrosion of metals, porous masses and their uses, powder metallurgy. Pertinent papers individually abstracted. (A general)

23-A. Stainless Steel Handbook. 120 p. 1956. Allegheny Ludlum Steel Corp., Pittsburgh, 22, Pa.

Analyses; properties; fabrication; applications. (A general; SS)

24-A. (Book.) **Year Book of American Iron and Steel Institute.** 268 p. 1956. American Iron and Steel Institute, 150 East 42nd St., New York 17, N. Y.

A collection of papers on steel's depreciation problem, joint responsibility of management and labor, and metallurgical aspects in the design of a new continuous annealing line. (A5, J23, 17-1; ST)

25-A (Book—French.) **Report of Activity Up to Dec. 31, 1954.** *Rapport d'Activite arrete au 31 Decembre 1954.* 362 p. 1956. L'Institut de Recherches de la Siderurgie (IRSID), 185 Rue Président Roosevelt, Saint-Germain-en-Laye (S.-&-O), France.

The situation of IRSID and activities of the Metallurgical Study Center (CESSID) at the end of 1954. The following studies were of special interest; ore enrichment, gravity separation, pneumatic separation, high and low-intensity magnetic separation and applications, making of pig iron with different cokes, speed and mechanism of reaction in metallurgy, variation of the ductility distribution in soft steels. (A9h; CI, CN)

B Ore and Raw Material Preparation

1-B. (Russian.) **Semicoking of Hard Fuels in an Active Gaseous Medium at High Pressure.** V. S. Al'tshuler and G. S. Shafir. *Khimiia i Tekhnologiia Topliva,* no. 10, Oct. 1956, p. 45-55.

Influence of a gaseous medium on the semicoking of hard fuels under pressure was tested. Esthonian schist and Ukrainian brown coal were used in a hydrogen and steam medium at pressures up to 100 atmospheres. (B17g; NM-q)

2-B. Reaction Zones in the Iron-Ore Sintering Process. R. D. Burlingame, Gust Bitsianes and T. L. Joseph. *Industrial Heating,* v. 23, Nov. 1956, p. 2375-2376, 2390.

To investigate changes that precede the formation of sinter, sintering zones were arrested after they progressed part way through the bed. When the sintering zone reached the half-way point, as indicated by the sudden increase in the hot junction temperature, the charge was quenched. (B16a; Fe)

3-B. Beneficiation Studies of Nickeliferous Ores From the Shamrock Mine, Jackson County, Ore., and the Congress Mine, Ferry County, Wash. J. E. Shelton. *U. S. Bureau of Mines, Report of Investigations* 5261, Oct. 1956, 8 p.

Bulk sulphide flotation to reduce the weight of product, before hydrometallurgical or pyrometallurgical treatment, offers the best method for utilizing the material. (B14h; Fe, Ni)

4-B. Development of a Chloride Volatilization Process for Manganese Ores From Aroostook County, Me.: Progress Report. R. T. MacMillan and T. L. Turner. *U. S. Bureau of Mines, Report of Investigations* 5281, Oct. 1956, 31 p.

Manganese chloride volatilization with gaseous hydrochloric acid; conversion of chloridization product to oxide form; recovery of hydrochloric acid from hydrolysis step for recycling to chloridizing furnace; test on controlling manganese-iron ratio in product; solubility study. (B15q; Mn)

5-B. A Mineral-Dressing Study of Manganese Deposits of West-Central Ark. M. M. Fine and D. W. Frommer. *U. S. Bureau of Mines, Report of Investigations* 5262, Oct. 1956, 21 p.

In most instances, a too-intimate association of manganese oxides and gangue is conducive to low grade, low recovery, or both, so that mechanical concentration processes do not promise much for this district. (B14; Mn)

6-B. (Czech.) **Evaluating Coke for Blast Furnaces. III. A New Method of Evaluating Coke.** O. Havel and V. Rerabek. *Paliva,* v. 36, no. 10, Oct. 1956, p. 329-334.

Evaluates present methods and compares mechanical testing methods and their inadequacies. Suggests simple method of evaluation to determine firmness, quantity of fragmentation, fragmentation resistance, and over-all quality. (B17, D1; NM-q 38)

7-B. (Russian.) **Nonfired Magnesite Chromium Brick.** G. G. Aristov and M. I. Panfilov. *Metallurg,* no. 10, Oct. 1956, p. 22-23.

The thermal dilatation of burnt magnesite chrome brick in open-hearth furnaces was compensated by the shrinkage of the nonfired bricks, and stress in the crown was relieved. (B19, D2; NM-h)

C Extraction and Refining

1-C. Solvent Extraction Separation of Uranium From Acid Leach Liquors and Pulps. J. R. Ross, J. B. Rosenbaum and J. B. Clemmer. *Intermountain Experiment Station, Bureau of Mines (U. S. Atomic Energy Commission),* AECU-3181, Apr. 1956, 18 p.

Pilot plant work using a kerosene solution of mono ortho dodecyl phosphoric acid. Tentative design for solvent extraction plant proposed. (C19; U)

2-C. Pressure Leaching and Reduction at the Garfield Refinery. J. S. Mitchell. *Mining Engineering,* v. 8, Nov. 1956, p. 1093-1095.

Cobalt recovery from arsenical concentrates involves auto-oxidation acid leaching, filtration of tailings, purification of solution, hydrogen reduction of ammoniacal solution, and electrical furnacing for sulphur removal and granulating metal. (C19, C21; Co)

3-C. Determination of the Number of Electrons Participating in the Electrochemical Reduction of Columbium and Titanium. E. I. Krylov and V. S. Kolevatova. *Henry Brutcher Translation No.* 3686, 6 p. (From *Zhurnal Fizicheskoi Khimii,* v. 29, no. 5, 1955, p. 818-821.) Henry Brutcher, Altadena, Calif.

Coulometric-polarographic determination of reduction stages. (C23, S11; Cb, Ti)

4-C. (English.) **Studies on Electrolytic Refining of Zinc. II. Cathodic Deposition of Lead Dissolved in Zinc Electrolyte.** Motoo Watanabe and Seitaro Fukushima. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 8, no. 5, Oct. 1956, p. 406-420.

The lead content in zinc which comes into the cathode only from the electrolytic deposition of ionic state lead was determined. Values of the limiting current density of lead ions estimated by applying diffusion theories. (C23; Zn, Pb)

5-C. (German.) **Method to Produce Aluminum Alloys With High-Melting Elements. II.** F. Erdmann-Jesnitzer and K. H. Erler. *Aluminium,* v. 32, no. 11, Nov. 1956, p. 712-716.

A mixture of metal oxides and aluminum turnings is scattered on the surface of the molten aluminum and ignited with an electric arc. (C general; Al)

6-C. Vacuum Treating Nonferrous Melts at U. S. Naval Gun Factory. Vincent DePierre and Shingo Inouye. *Foundry,* v. 84, Dec. 1956, p. 108-114.

Vacuum treating procedure used in two production units for nonferrous melts. The smaller treats 200 lb. of aluminum or 600 of bronze; the larger treats 600 lb. of aluminum or 1800 of bronze. (C25; Cu, Al)

7-C. The Pyrometallurgy of Halides. W. J. Kroll. *Metallurgical Reviews,* v. 1, pt. 3, 1956, p. 291-337.

Recent progress in the use of halides in extractive metallurgy. (C1p)

8-C. Zone Melting by Electric Arc. R. D. Burch. *North American Aviation, Inc. (U. S. Atomic Energy Commission),* NAA-SR-1688, Nov. 1956, 16 p.

Apparatus uses d.c. arc to produce a molten region. Specimen metal bar rests on a water-cooled hearth and serves as an anode. (C5k)

9-C. Processing of Power Reactor Fuels. R. E. Blanco. *Nuclear Science and Engineering,* v. 1, Oct. 1956, p. 409-419.

Chemical principles affecting a multipurpose centrally located solvent extraction plant which would process all types of heterogeneous fuels. (C19, T11)

10-C. Electric Smelting of Low-Grade Chromite Concentrates. J. P. Walsted. *U. S. Bureau of Mines, Report of Investigations* 5268, Oct. 1956, 28 p.

Proper proportioning includes the correct level of reductant, enough bulk to provide porosity, and the minimum amount of flux to provide a minimum amount of slag of good fluidity. (C21d; Cr)

11-C. (French.) **Heating in Vacuum by Induction.** A. Bussard. *Métallurgie et la Construction Mécanique,* v. 88, no. 10, Oct. 1956, p. 847-849.

Present field of vacuum melting, designs, characteristics of melting furnaces with conducting or nonconducting crucible. (C25)

12-C. (Russian.) **Using Aluminum Powder for Melting Ferrotitanium.** P. F. Snezhko. *Metallurg,* no. 10, Oct. 1956, p. 21-22.

Melting of the furnace charge with a pulverized fraction of aluminum took place smoothly and was accompanied by a considerable reduction of titanium. The consumption of aluminum was sharply reduced. (C26; Fe, Ti, Al, AD-n)

13-C. (Russian.) **Analysis of Indices and Peculiarities of Electrosmelting Ferrosilicon and Chromium-Silicon at Two Plants.** V. V. Rukavishnikov and V. A. Kravchenko. *Stal',* v. 16, no. 11, Nov. 1956, p. 989-993.

A comparison of output at two plants. Effects of depth of immersion of electrodes in the charge; proper slag treatment. (C21d, Fe, Si, Cr, AD-n 31)

14-C. (Russian.) **Refining Tellurium and Antimony.** F. I. Vasenin. *Fizika Metallov i Metallovedenie*, v. 3, no. 2, 1956, p. 360-362.

Use of a special retort-dephlegmator for distilling off tellurium and antimony of very high purity. (C22h; Sb, Te)

D Iron and Steelmaking

1-D. More Iron Without More Furnaces. II. Increasing the Driving Rate. Charles M. Squarcy and Richard J. Wilson. *Steel*, v. 139, Nov. 26, 1956, p. 98 + 4 pages.

Experience with high top pressure furnaces; effects of oxygen-enrichment and steam injection; other factors affecting production rate. (D1h; Fe)

2-D. More Iron Without More Furnaces. I. Lowering the Coke Rate. Charles M. Squarcy and Richard J. Wilson. *Steel*, v. 139, Nov. 19, 1956, p. 150 + 5 pages.

Several alternative methods are suggested to increase blast furnace production by lowering coke rate and increasing driving rate. (D1h; Fe)

3-D. Vanadium in Acid Steelmaking Process and Deoxidizing Power of Vanadium. I. A. Popov and B. V. Stark. *Henry Brutcher Translation No.* 2843-B, 12 p. (From *Izvestiya Akademii Nauk SSSR, OTN*, no. 2, 1951, p. 261-266.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 220-D, 1951. (D11r; ST, V)

4-D. Effect of Mold Wall Thickness Upon Solidification of Ingots. N. N. Rubtsov and G. F. Balandin. *Henry Brutcher Translation No.* 3209, 17 p. (From *Liteinoe Proizvodstvo, 1952*, no. 4, Apr. 1952, p. 16-19.) Henry Brutcher, Altadena, Calif.

Solidification time for steel ingots as a function of thickness of gray iron mold; variation in temperatures of outside and inside mold walls during solidification of steel ingots. Calculations using the method of successive approximations. (D9; ST)

5-D. Effect of Addition of Metallic Bismuth to Liquid Steel. V. S.Bozhko. *Henry Brutcher Translation No.* 3216, 5 p. (From *Trudy Instituta Chernoi Metallurgii*, v. 7, 1953, p. 54-56.) Henry Brutcher, Altadena, Calif.

Influence of additions in the ladle, mold or bottom-pouring mechanism upon casting properties, nonmetallic inclusions and mechanical characteristics. (D9; Bi, ST)

6-D. Lining of Top-Blown Oxygen Converters at Donawitz (Austria) Steelworks. A. Wegscheider. *Henry Brutcher, Translation No.* 3783, 14 p. (Abridged from *Stahl und Eisen*, v. 76, no. 10, 1956, p. 595-599.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 248-D, 1956. (D10; NM-h, ST)

7-D. Development and Industrial Application of Continuous Casting of Steel. M. S. Boichenko, V. S. Rutes and N. A. Nikolaev. *Henry Brutcher Translation No.* 3818, 18 p. (Abridged from *Stal'*, v. 16, no. 6, 1956, p. 505-513.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 315-D, 1956. (D9q; ST)

8-D. Industrial-Scale Trials on the Injection of Argon for Flushing Hydrogen Out of Arc on O. H. Steel Baths. M. Imai, T. Nakayama and H. Oi. *Henry Brutcher Translation No.* 3827, 5 p. (Abridged from *Tetsu to Hagane*, v. 41, no. 9, Sept. 1955, p. 1033-1034.) Henry Brutcher, Altadena, Calif.

Effect of argon flushing shortly before the tap on hydrogen content of chromium steels and plain carbon steels. Bath compositions before argon injection, data on procedure in treating baths with argon. (D2g, D5g; A, AY, CN)

9-D. (Czech.) **Thermal Effect of Artificially Moistened Wind on the Processes in the Blast Furnace Hearth.** Miroslav Prouza. *Hutnické Listy*, v. 11, no. 10, Oct. 1956, p. 577-579.

Effect of humid air on heat balance of blast furnace hearth. Use of vapor is inseparably combined with the preheating of air to high temperature. (D1h, D11k; Fe)

10-D. (Czech.) **Treatment of Stainless Scrap With Oxygen in Openhearth Furnace.** V. Cerny and Zdenko Zdenek. *Hutnické Listy*, v. 11, no. 11, no. 10, Oct. 1956, p. 579-583.

Chromium-nickel and chromium-nickel-molybdenum wastes treated with oxygen in the openhearth furnace can be easily rolled and have good corrosion resistance. (D2g, B23; SS)

11-D. (German.) **Slag Regulation During the Production of Manganese-Rich Pig Iron in the Low-Shaft Blast Furnace.** Georg Brückner. *Neue Hütte*, v. 1, no. 8, Sept. 1956, p. 449-456.

Influence of slag components upon melting heat, melting temperature and viscosity. Optimum slag composition and other variables. (D8p; NM-p, Fe)

12-D. (German.) **Production of High Quality Steel in Blast Converter.** Kurt Rösner and Alfred Wegscheider. *Stahl und Eisen*, v. 76, no. 21, Oct. 18, 1956, p. 1337-1343.

Refining, decrease of sulphur content, production of carbon-free steel in blast converter. (D8; ST)

13-D. (Russian.) **Iron Ion Transport Numbers in Molten Iron Silicates.** O. A. Esin and A. K. Kir'ianov. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, no. 8, Aug. 1956, p. 20-27.

Methods and design of electrolyzer for determining transport numbers of cations of iron in molten slag of varying composition. Conductivity of molten slag. (D11n; Fe)

14-D. (Russian.) **"Evaporation" of Iron During Blow of Pig Iron in Converters.** P. Ia. Sorokin. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1956, no. 8, Aug. 1956, p. 28-36.

Ejection of iron oxide particles from the bath surface during blowing of pig iron in Bessemer converters. Mechanism of oxidation of elements during blow. (D3; Fe)

15-D. (Russian.) **Teeming of Steel With Arc-Heating of Deadhead.** B. N. Popov. *Metallurg*, no. 9, Sept. 1956, p. 19-22.

Method and installation for arc heating, economics and advantages for rolling. (D9; ST)

16-D. (Russian.) **Use of Fluxes to Reduce Slag Viscosity in Casting Molds When Teeming Rimmed Steel.** K. S. Alferov, V. O. Kulikov and T. G. Kovaleva. *Metallurg*, no. 9, Sept. 1956, p. 22-24.

Addition of flux, like ground glass, to reduce slag area on rimmed steel; its intrusion into the steel. (D9; NM-p, ST)

17-D. A Metallographic and Mineralogical Study of a Basic Openhearth Heat. Peter M. Power and John C. Campbell. *Canadian Mining and Metallurgical Bulletin*, v. 49, no. 535, Nov. 1956, p. 793-802.

As various impurities in the bath are oxidized, the metal structure changes from that of high-phosphorus white cast iron to that of low-carbon steel. Phosphorus distribution was studied. The acid run-off slag has an acicular orthosilicate structure which changes on "shape-up" to a very basic tricalcium silicate and calcium ferrite structure. (D2, D11r; ST)

18-D. Heat Transfer in the Openhearth Furnace. II. M. W. Thring. *Industrial Heating*, v. 23, Nov. 1956, p. 2384, 2386, 2388, 2390.

The effects of various improvements in furnace operation on the calculations are considered and comparison is made between calculated thermal efficiency and efficiency actually observed. (D2, D11k)

19-D. Some Methods for Analyzing and Controlling an Openhearth Operation. Eugene H. Swett. *Iron and Steel Engineer*, v. 33, Nov. 1956, p. 109-113.

Statistical analysis of certain variables illustrates their effect upon production rate or product quality. (D2, S12)

20-D. Equilibria in Reactions of Hydrogen and Carbon Monoxide With Dissolved Oxygen in Liquid Iron; Equilibrium in Reduction of Ferrous Oxide With Hydrogen, and Solubility of Oxygen in Liquid Iron. Nev A. Gokcen. *Journal of Metals*, v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, Nov. 1956, p. 1558-1567.

Results are expressed in thermodynamic functions and correlated with new data on the standard free energies of H_2, H_2O, O_2, CO and CO_2. (D11r, P12a; ST)

21-D. Hydrogen in Steelmaking Slags. J. H. Walsh, J. Chipman, T. B. King and N. J. Grant. *Journal of Metals*, v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, Nov. 1956, p. 1568-1576.

Slag and metal samples from a number of industrial heats were analyzed and the important role of the slag in determining the hydrogen content of the metal was confirmed. (D11n; NM-p)

22-D. (German.) **Investigations for Testing the Behavior of Ores in the Blast Furnace.** Jacob Willems, Peter Dickens and Wilhelm vor dem Esche. *Stahl und Eisen*, v. 76, no. 22, Nov. 1, 1956, p. 1404-1409.

Studies expansion and softening values of ores and sinters and the mineralogical structure of the ores. (D1; ST, AD-s36)

23-D. (German.) **Nonmetallic Deposits on the Sprue and Wear of Runner Bricks With Killed Openhearth Steels.** Karl Georg Speith, Hans vom Ende and Hans-Joachim Seelisch. *Stahl und Eisen*, v. 76, no. 22, Nov. 1, 1956, p. 1426-1441.

Tests with runner bricks having different alumina contents for pouring soft and medium hard killed steels. (D9n; NM-h, ST)

24-D. The Changing Open-Hearth Picture. Kenneth C. McCutcheon. *Blast Furnace and Steel Plant*, v. 44, Dec. 1956, p. 1411-1416.

Comparison of 1947 with 1956 operating data. (D2; ST)

25-D. Sponge Iron and H-Iron for Electric Furnace Charging. P. E. Cavanagh. *Journal of Metals*, v. 8, Dec. 1956, p. 1642-1644.

Use of virgin melting stock means lower furnace operating costs, lower rolling, forging and annealing costs, and improved customer relations re-

sulting from a known and uniform quality steel. (D5; Fe)

26-D. Desiliconized Pig Iron for the Electric Furnace—A Possibility. S. L. Case. *Journal of Metals,* v. 8, Dec. 1956, p. 1645.

Advantages of desiliconizing the pig before charging make an important difference in costs. (D5; CI)

27-D. (English.) **On Heredity of Pig-Iron. II. Effects of Various Gas Bubblings Into Molten Pig Irons.** Ichiro Iitaka, Kokichi Nakamura and Masao Kikuchi. *Castings Research Laboratory, Report, Waseda University,* 1956, no. 7, p. 1-5.

Experiments with hydrogen and oxygen. Comparisons with magnesium additions. (D1d; Fe)

28-D. (German.) **The Causes of Blast Furnace Explosions and Conclusions to be Drawn for the Design and Operation of Blast Furnaces.** Werner Feldmann. *Stahl und Eisen,* v. 76, no. 23, Nov. 15, 1956, p. 1541-1553.

Explosions are dependent on the blast furnace operation. Safety measures to be taken. (D1b, A7p, 18-17)

29-D. (Russian.) **The Structure of Magnetite in the Reaction Diffusion Layers in the Reduction of Hematite.** V. I. Arkharov and V. N. Bogoslovskii. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 254-268.

Details of the reduction process gained by studying the peculiarities of the structure of the magnetite phase. Regulating the kinetics of iron oxide reduction. (D11r, M27; Fe, 14-9)

30-D. (Russian.) **Overheating of Side-Blown Converter Steel.** V. A. Fuklev and L. K. Grakhov. *Liteinoe Proizvodstvo,* no. 10, Oct. 1956, p. 9-10.

Overheating of steel in relation to silicon and carbon contents. (D3f; ST)

31-D. (Russian.) **New Investigation of the Coke-Combustion Process in Tuyere Area of a Blast Furnace.** M. Ia. Ostroukhov and L. Z. Khodak. *Stal',* v. 16, no. 10, Oct. 1956, p. 867-872.

Study of the vortex character of gas motion in the oxidation zone. Useful data for operation. (D11k, D1b; Fe, NM-q38)

32-D. (Russian.) **Feeding Oxygen in the Jet of a High-Capacity Open-hearth Furnace During Remelting of Phosphorus Cast Iron.** *Stal',* v. 16, no. 10, Oct. 1956, p. 875-882.

Introduction of oxygen results in reduction of smelting time, and a 17% increase in furnace capacity with no detrimental effect on steel quality. (D2q; ST)

33-D. (Russian.) **Processes of Solidification and Heat Transfer Under Conditions of Continuous Teeming.** *Stal',* v. 16, no. Oct. 1956, p. 883-890.

Application of thermohydraulic integrator for determination of optimum working parameters. (D9p, X9; ST)

34-D. (Russian.) **Using Oxygen in Electric Steel Melting.** N. I. Shutkin. *Stal',* v. 16, no. 10, Oct. 1956, p. 890-894.

Oxygen introduction permits a 30-35% increase in capacity and a 35-50% decrease in electrical energy consumption with no detriment to the metal quality. (D5q; ST)

35-D. (Russian.) **Calculation of Self-Sintering Electrode Diameters of Ore-Reducing Electric Furnaces.** E. M. Alekseev. *Stal',* v. 16, no. 10, Oct. 1956, p. 894-896.

Relation between current density and the specific consumption of the electrode mass. (D8n; ST)

36-D. (Russian.) **The Operation of Blast Furnaces With Gas at a Gauge Pressure of 0.8.** P. F. Sergeev and N. I. Vasil'chenko. *Stal',* v. 16, no. 11, Nov. 1956, p. 963-971.

Increasing output, lowering coke consumption and reducing flue dust by raising the pressure of the gas at the throat of the blast furnace. Equipment required and changes made. (D1h; Fe)

37-D. (Russian.) **Reducing Rimmed Steel in the Ladle With Ferromanganese.** I. I. Bornatskii, K. S. Alferov and V. I. Prilepskii. *Stal',* v. 16, no. 11, Nov. 1956, p. 977-983.

Test results indicate that the method produces satisfactory metal with an average saving in ferromanganese of about 22%. (D9r; ST, AD-n)

38-D. (Russian.) **Using Compressed Air in Openhearth Furnaces.** V. N. Kazantsev. *Stal',* v. 16, no. 11, Nov. 1956, p. 984-988.

Using compressed air at a pressure of 4 atmospheres shortens the smelting process to 40-50 min. Description of burners, operating pressures and conditions. (D2h; ST)

E Foundry

1-E. Design and Production of Aluminum Castings. G. W. Birdsall. *Aero Digest,* v. 73, Nov. 1956, p. 13-19.

Data to help designers select casting process and aluminum alloy best suited for product requirements. Includes casting tolerances, corrosion resistance, fabricating characteristics, comparison of casting methods. (E general, 18-17; Al)

2-E. Gating and Risering in the Brass Foundry. Harry St. John. *Foundry,* v. 84, Nov. 1956, p. 108-111.

Considers the complex problem of feeding castings to make up for shrinkage during solidification. (E22, E25; Cu)

3-E. New Plant Produces Mercury Investment Castings. Thomas A. Dickinson. *Foundry,* v. 84, Nov. 1956, p. 133-135.

Casting technique is making possible the use of steel aircraft castings in place of forgings. Frozen mercury patterns are used to make ceramic molds into which castings are poured. (E15, W19; AY)

4-E. The Refinement of Cast Grain-Size in Copper-Aluminium Alloys Containing 7-9 Per Cent Aluminium. J. P. Dennison and E. V. Tull. *Institute of Metals, Journal,* v. 85, Sept. 1956, p. 8-10.

Introduction of selected nucleating compounds showed that in the alloys in which the α phase solidifies first, moderate refinement may be produced by additions of molybdenum, columbium, tungsten or vanadium of the order of 0.1%. (E25; AD-p35, Cu)

5-E. (Czech.) **Properties of Molding Materials at Elevated Temperatures.** Lev Petrzela. *Slévarenstvi,* v, 4, no. 10; *Prace Ceskoslovenského vyzkumu slévarenského,* v. 3, no. 36, Oct. 1956, p. 255-264.

Mold material failures are studied from 400 to 1200° C. (W19, NM-j)

6-E. (Russian.) **Sand-Resin Mixtures for Shell Molds and Cores.** I. E. Shub and P. I. Kantor. *Liteinoe Proizvodstvo,* no. 9, Sept. 1956, p. 1-5.

Present domestic and foreign practices in preparing sand-resin mixtures for shell molding. (E19c; NM-j)

7-E. (Russian.) **A Substitute for Powder Bakelite in Shell Mold Manufacture.** A. M. Liass, Ia. I. Medvedev and L. D. Snulova. *Liteinoe Proizvodstvo,* no. 9, Sept. 1956, p. 10-13.

Experimental data on the technical properties of wood-tar pitch as a substitute for phenol-formaldehyde resins in binding shell molds. Use of additional solvents with the pitch is indicated. (E19c; NM-j)

8-E. (Russian.) **Effective Use of Clay in Mixtures for Mold Manufacture.** N. A. Barinov and D. I. Manreev. *Liteinoe Proizvodstvo,* no. 9, Sept. 1956, p. 13-14.

Advantages of using clay in the suspension form instead of powder in mixtures for shell molds. (E19c; NM-h)

9-E. (Russian.) **Deformation of the Sand Mold During Steel Casting.** A. M. Dubrovskii. *Liteinoe Proizvodstvo,* no. 9, Sept. 1956, p. 22-26.

Effect of the deformation of mold mixture with temperature on the development of internal stresses in the castings. (E23, Q25; ST)

10-E. Control of Shrinkage Defects in Cast Iron. I. John Allan. *Canadian Metals,* v. 19, Nov. 1956, p. 36, 38, 40, 42.

Types of shrinkage, gating and metal composition, pouring, metal temperature, melting conditions, sand deformation. (To be concluded.) (E25n, 9-18; CI)

11-E. New Plant for Super-Alloy Production in Canada. G. W. Paget. *Canadian Metals,* v. 19, Nov. 1956, p. 54, 56, 58.

Standard sand molding techniques, shell molding, lost wax process, and Shaw process are used. Stellite facing increases service life of parts produced. (E general; SG-h)

12-E. Shrinkage in Gray Cast Iron. John Allan. *Foundry,* v. 84, Dec. 1956, p. 88-95.

Methods of casting, problems and defects of shrinkage, controlled progressive solidification. Recommendations for solving these problems. (E25n, 9-18; CI)

13-E. Brass Foundry Molding. Harry St. John. *Foundry,* v. 84, Dec. 1956, p. 104-107.

Basic fundamentals of grain size and shape, bonding materials, additives and processing as they affect molding sands. (E18p; Cu)

14-E. Dimensioning of Risers for Nodular Iron Castings. H. F. Bishop and C. G. Ackerlind. *Foundry,* v. 84, Dec. 1956, p. 115-119.

System for determining smallest risers which can be employed on nodular iron castings with underriser shrinkage. (E22q; CI)

15-E. Melting by Induction. II. High Frequency Furnace Applications. Frank T. Chestnut. *Industrial Heating,* v. 23, Nov. 1956, p. 2356 + 6 pages.

Application of high-frequency furnace for melting steels, copper alloys and other metals. (E10r; ST, Cu)

16-E. Holding Close Tolerances on Die-Cast Parts. H. K. Barton and L. C. Barton. *Machinery,* v. 63, Dec. 1956, p. 182-188.

Causes of dimensional errors, checking for errors of alignment and concentricity, correction and inspection of die-cast parts, gaging fixture for an instrument frame, importance of "realistic" dimensioning, checking screw threads. (E13, S14)

17-E. New High-Strength Copper Alloy. J. F. Klement and N. A. Birch. *Metal Progress,* v. 70, Nov. 1956, p. 106-109.

New British aluminum bronze containing 12% manganese has better casting properties and more attrac-

tive mechanical properties than the conventional high-strength bronzes. (E general, Q general; Cu)

18-E. Melting Metal With Sun-Power. D. C. Halacy, Jr. *Modern Castings,* v. 30, Dec. 1956, p. 28-29.

In the United States, Convair uses the solar furnace in work with metals, "cermets", ceramics, zirconium dioxide, boron nitride and other materials. General Electric purifies phosphors for use in communications equipment. (E10b, 16-13)

19-E. How to Improve Foundry Layout. Roger B. Sinclair. *Modern Castings,* v. 30, Dec. 1956, p. 35-46.

Benefits of a good layout include labor costs, materials handling, flexibility and economy. How to plan a layout, methods of applying plans. (E general, A5)

20-E. Choke That Gate. Charles V. Knobeloch. *Modern Castings,* v. 30, Dec. 1956, p. 48-50.

The proposed gating system in regulating metal flow in casting procedures should be as automatic in control functions as possible to eliminate variables. Methods and plans are presented. (E22p)

21-E. (German.) **Light Metal Casting.** H. F. Freres. *VDI Zeitschrift,* v. 98, no. 31, Nov. 1956, p. 1770-1771.

Continuous die casting of finned pipes of pure aluminum of optional length. (E13; Al)

22-E. (German.) **Progressive Casting and Molding Methods.** F. Pölzguter. *VDI Zeitschrift,* v. 98, no. 31, Nov. 1956, p. 1772-1774.

Various German processes were studied, such as the centrifugal casting method for pipes and barrels, the carbonic acid freezing method for compact molds, and precision casting. (E14, E15)

23-E. Effect of Vibrations During Solidification on the Mechanical Properties of Castings of Gas-Turbine Materials. Jerzy Jagaciak and Josiah W. Jones. *Foundry Trade Journal,* v. 101, Nov. 22, 1956, p. 595-603.

Tests on H.R. Crown Max and Nimonic C75 show an over-all improvement in properties. (E25n, Q general; Ni, SG-h)

24-E. (English.) **Gas Pressure in Mold Cavity. I.** Mototaka Mutaguchi. *Castings Research Laboratory, Report, Waseda University,* 1956, no. 7, p. 29-32.

Relation between pressure and permeability, temperature and permeability, and temperature and mean molecular weight. (E25q, 3-24)

25-E. (English.) **Inorganic Binders for Molds; Especially on Soda Silicate Prepared for the CO_2 Process.** Hisao Miyasaka. *Castings Research Laboratory, Report, Waseda University,* 1956, no. 7, p. 33-40.

Experiments with four different types of water glasses; chemical reaction involved. (E18n; NM-j45)

26-E. (Russian.) **Use of Oxygen in Cast Iron Production.** L. I. Levi. *Liteinoe Proizvodstvo,* no. 10, Oct. 1956, p. 1-5.

Method of introducing oxygen into a cupola furnace through a forehearth; advantages. (E10a; CI, O)

27-E. (Russian.) **Simultaneous Modification and Degasification of Aluminum Alloys.** A. A. Gorshkov and V. G. Korotkov. *Liteinoe Proizvodstvo,* no. 10, Oct. 1956, p. 6-9.

Consists of adding low-melting chlorides instead of the metals or their alloys. (E25s; Al, AD-p)

28-E. (Russian.) **Production of Overheated Cast Iron in a Magnesite-Lined Hot Blast Cupola.** F. I. Smirnov. *Liteinoe Proizvodstvo,* 1956, no. 10, Oct. 1956, p. 10-13.

Method and construction details of preheating blast air by hot exhaust gases. (E10a; CI)

F Primary Mechanical Working

1-F. (French.) **Influence of the Furnace Atmosphere on the Calamine Formation in Billets.** J. Moreau. *Centre de Documentation Sidérurgique, Circulaire d'Informations Techniques,* v. 13, no. 10, 1956, p. 1973-1982.

Rough rolled and scraped billets of various steels were passed through furnaces differing in the heating method used. The conditions of heating, the superficial and internal formation of calamine and various problems were examined. (F21; ST)

2-F. (German.) **Production of Acid-Resisting Plated Sheet Steel.** Richard O'Donnel. *Neue Hütte,* v. 1, no. 8, Sept. 1956, p. 469-475.

Covers preparation and piling, preheating, roughing, intermediate rolldown and sheeting. (F21, F23; ST)

3-F. (German.) **Phenomena in Roll Gap and Their Influence on Roll Force and Torque in Hot Rolling.** Werner Lueg and Hans Günter Müller. *Stahl und Eisen,* v. 76, no. 21, Oct. 18, 1956, p. 1343-1356.

Speed of compression, deformation resistance, behavior of lever arm, pressure distribution, temperature. (F23)

4-F. Effects of Screw and Speed-Setting Changes on Gauge Speed and Tension in Tandem Mills. W. C. F. Hessenberg and W. N. Jenkins. *Institution of Mechanical Engineers, Proceedings,* v. 169, no. 52, 1955, p. 1051-1062.

Relates changes in interstand tension and finishing gage. Predicts behavior of tandem mills under various conditions. (F23, W22)

5-F. Control Flatness of High Strength PH Sheet. L. E. Laux. *Iron Age,* v. 178, Nov. 29, 1956, p. 84-86.

Tensile strength required of the heat treated 17-7 PH stainless steel sheet ranges from 180,000 to 210,000 psi. After this preliminary flattening, sheets undergo vapor degreasing first, then cleaning by the electro-alkaline process. (F29s, L12j, L12k; SS, 4-3)

6-F. A Mill for Cold Rolling Metals to Close Tolerances. Michael G. Sendzimir and Ludwik Zdanowicz. *Iron and Steel Engineer,* v. 33, Nov. 1956, p. 65-70.

Mill is used for both ferrous and nonferrous metals where surface finish standards and tolerances are unusually rigid. Large reductions may be obtained in a single pass. (F23, W22)

7-F. Rolling Mills for Processing Nuclear Fuel Elements. A. I. Nussbaum. *Iron and Steel Engineer,* v. 33, Nov. 1956, p. 93-103.

Fundamental design and operation, basic materials and their workability, glovebox enclosures, sequence of fabrication, reprocessing spent fuel. (F23, T11)

8-F. Selection of a Lubricant for Cold Drawing. I. Coarse Steel Wire. Bruce W. Siemon. **II. Fine Steel Wire.** W. B. Bauzenberger. *Iron and Steel Engineer,* v. 33, Nov. 1956, p. 105-108.

Applications of various types of lubricants. Speed and severity of drawing, material and desired product finish are factors influencing selection. (F28; NM-m, ST)

9-F. Increased Heating Rates for Steel Ingots. P. M. Cook and J. D. Stringer. *Iron and Steel Institute, Journal,* v. 184, Nov. 1956, p. 309-315.

Potential advantages of rapid heating are increased production from existing furnace capacity, reduction of scale losses and decarburization, and fuel economy. (F21b; ST, 5-9)

10-F. Extrusion of Metals. P. Feltham. *Metal Treatment and Drop Forging,* v. 23, Nov. 1956, p. 440-444.

Relations between extrusion force, ram velocity, friction at the billet container interface, and high-temperature rheological properties of metals are established and used to evaluate extrusion pressures for aluminum, copper, and lead. (F24; Al, Cu, Pb)

11-F. We're Ready for Volume Business, Say Extruders of Titanium. *Steel,* v. 139, Dec. 10, 1956, p. 142-145.

U. S. extruders and what they are doing. Current extrusion practice with reference to temperature, lubricants, protection, roughness. (F24; Ti)

12-F. Wire Flattening Practice. R. D. Weber. *Wire Industry,* v. 23, Nov. 1956, p. 1007, 1009-1012, 1030.

Wire flattening as a means of increased production, plant layout, production of transformer strip, cost data. (F29s; 4-11)

13-F. (German.) **The Load on a Three-High Finishing Stand and on Its Drive in Rolling Sheet, Bars, and Billets.** Werner Lueg and Hans-Gunter Muller. *Stahl und Eisen,* v. 76, no. 22, Nov. 1, 1956, p. 1457-1463.

Peaks of roll force and torque and their causes; distribution of the torque on the coupling spindles. (F23, ST)

14-F. Great Falls Billet Plant. Roy H. Miller and L. J. Ingvalson. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Dec. 1956, p. 1661-1664.

Construction and operation of plant which produces 3-in. diameter billets with a high phosphorus content from cathode copper. (F23, 18-19; Cu)

15-F. (German.) **The Problem of Load Distribution on Continuous Billet Rolling Mill Trains.** Werner Lueg and Hans Günt Müller. *Stahl und Eisen,* v. 76, no. 23, Nov. 15, 1956, p. 1562-1564.

Effects of longitudinal pull and pressure in the rolled product on the load absorbed in the stands. (F23, 3-24; ST)

16-F. (Russian.) **Effect of Technological Factors of Rolling on the Quality of Bessemer Rails.** N. I. Beda, N. K. Borisenko, G. P. Kotov and E. M. Mal'tseva. *Stal',* v. 16, no. 10, Oct. 1956, p. 897-900.

Effect of the temperature of rolling, deformation of metal during blooming and condition of roll surface. Optimal soaking temperature of ingots. (F23, 2-11, F21b; ST)

17-F. (Russian.) **Effect of Sections and Temperature of Rolls on Weldability in Sheet Pack Rolling.** D. I. Suiarov and P. F. Zasukha. *Stal',* v. 16, no. 10, Oct. 1956, p. 901-904.

Optimum temperature of rolls and sheets to prevent welding of the latter during rolling. (F23, 2-11; ST, 4-3)

18-F. (Russian.) **Manufacture of Seamless Thin-Wall Pipes of Large and Medium Diameters.** S. I. Borisov. *Stal',* v. 16, no. 10, Oct. 1956, p. 905-908.

Suggestions for improvements in manufacturing large pipes for the petroleum industry. (F26; ST)

19-F. (Russian.) **Rolling Square Steel Sections With Sharp Corners.** M. V.

Miller Phosphor Bronze is consistently chosen for the tough jobs—in this instance a switch part that must withstand an estimated 750,000 "on and offs" without fatigue or fracture.

Miller *specializes* in the tailor-made production of phosphor bronze alloys—in strip, coiled and flat lengths—best fitted to your needs. At Miller, Phosphor Bronze is the main line, *not* a sideline.

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Shuralev and S. G. Nekrasov. *Stal'*, v. 16, no. 11, Nov. 1956, p. 997-999.

A method was developed for accurate rolling of sections with sharp corners and flat faces. Discussion of changes made in equipment and rolling procedures. (F23; ST)

Secondary Mechanical Working

Forming and Machining

1-G. (Dutch.) **Problems in Deep Drawing Research.** J. H. Zaat. *Metaalinstituut T. N. O.*, no. 41, June 1956, 8 p.

Discusses why, where and how deep drawing research should be carried out. (G4, A9)

2-G. Plate Bending by Rolling. Uses of Various Types of Machines. E. L. Tinley. *Engineering*, v. 182, Nov. 16, 1956, p. 623-625.

Roll materials and roll-surface finish; working with shim-plates for irregular shapes; forms of roll drive; bending cones; dual-purpose machines adapted for bending sections; hot working of plate; flexing roll machines. (G11, W24)

3-G. Formability of Metals. III. Press Operations. Lester F. Spencer. *Finish*, v. 13, Dec. 1956, p. 33-35, 37.

Die clearance factor, importance of sharpness, blanking of shapes, punching and piercing, influence of bend radius, press brake forming, flanging and beading operations. (G1, 18-1)

4-G. How Troubleshooting Makes Bending Easier. Federico Strasser. *Iron Age*, v. 178, Dec. 6, 1956, p. 132-134.

Points to consider in locating potential trouble spots. Bending operations. (G6)

5-G. Stretch Forming Under Fluid Pressure. P. B. Mellor. *Journal of the Mechanics and Physics of Solids*, v. 5, Nov. 1956, p. 41-56.

An investigation into the hydrostatic bulging of circular metal diaphragms. Derivation of strain-hardening characteristics for several materials. (G14b)

6-G. Dimpling Stainless Steel Foil. J. E. Hagins. *Machinery (London)*, v. 89, Nov. 16, 1956, p. 1126-1127.

To avoid problems associated with wrinkling and cracking, the sheets are embossed with a pattern of dimples using an aluminum embossing die. (G3; SS, 4-6)

7-G. (German.) **Metal Cutting of Copper and Copper Alloys With Hard Metal Tools.** J. Witthoff. *Technische Mitteilungen Krupp*, v. 14, no. 5, Nov. 1956, p. 123-131.

Grinding, lapping and polishing of different types of copper and copper alloys; various phases of machining. (G18, G19, G17, T-6; Cu, 18-2)

8-G. Shot-Peening as Protection of Surface-Damage Propeller-Blade Materials. J. M. Lessells and R. F. Brodrick. Paper from "International Conference on Fatigue of Metals". v. III. The Institution of Mechanical Engineers. 13 p. + 2 plates.

Shot-peening, if properly controlled, considerably improves fatigue strength of subsequently damaged surfaces. Maximum improvement occurs under conditions where the depth of the compressive zone is about five times that of the gouge depth. (G23n, Q23g; ST)

9-G. (Russian.) **Cutting Steel With Oxygen in Continuous Casting Plants.** O. Sh. Spektor. *Stal'*, v. 16, no. 11, Nov. 1956, p. 1042-1048.

Details of apparatus and tech-

niques for horizontal cutting of carbon steel heated from 800 to 1200° C. (G22, D9q; CN)

10-G. (Russian.) **Effect of Cold Hardening on Drawing of Heat Resistant Materials.** N. F. Pronkin. *Stanki i Instrument*, v. 27, no. 10, Oct. 1956, p. 29-31.

Effect of cold hardening on machinability and strength. Experimetal data. Method and devices of investigation. (G4, G17, 18-1; SG-h)

H Powder Metallurgy

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They're becoming larger, more intricate in cross section. New presses can make production quantities of shapes that once would have required costly tooling. (H14, 8-22)

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Manufacture and applications of porous metal articles. (H general, T29, 8-21)

4-H. Powder Metallurgy. Ivor Jenkins. Paper from "Chemical Engineering Practice". v. II. Academic Press. p. 483-532.

Manufacture, properties and testing of metal powders; principles of compacting and sintering; general engineering components; future trends. (H general)

J Heat Treatment

1-J. Some Aspects of Decarburisation. F. H. Robinson. *Australasian Engineer*, v. 48, Sept. 1956, p. 42-51.

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2-J. Control Measures for the Heat Treatment of High Carbon Rods and Wire. N. Dale Montgomery. *Wire and Wire Products*, v. 31, Nov. 1956, p. 1325-1326, 1390-1391.

Control measures instituted in annealing, patenting and oil tempering operations. (J23, J25, J29; CN, 4-5, 4-11)

3-J. Physical Principles of Electric Heating in an Electrolyte. I-II. Processes Developed for Heating (for Hardening) in an Electrolyte. I. Z. Yasnogorodskii. *Henry Brutcher Translation Nos.* 3204, 3205, 3210, and 3211; 11, 26, 18 and 18 p. (From *Heating of Metals and Alloys in an Electrolyte*, Moscow, 1949, Chap. 1, Sec. 1-5; Chap. 2, Sec. 1-4.) Henry Brutcher, Altadena, Calif.

Consists in treating the work to be heated as a cathode in an aqueous electrolyte at about 120 to 160° F. with a direct current of about 200 volts. (J2)

4-J. (English.) **On the Heat Treatment of Ti-Ni Alloys.** Takashi Araki. *Journal of Mechanical Laboratory (Japan)*, v. 2, no. 1, 1956, p. 28-31.

Investigation on the effects of quenching and isothermal heat treatment on the hardening and structure of the alloys with 2 - 12% nickel. (J26; Ti)

5-J. (French.) **The Heat Treatment of Light Alloys.** T. R. G. Williams. *Revue de Métallurgie*, v. 53, no. 10, Oct. 1956, p. 791-795.

Factors governing heat treatment, annealing, aging and stress relief annealing of aluminum and its alloys. (J general; Al)

6-J. (German.) **Investigation of Strain Hardened, Low-Carbon, Manganiferous Structural Steels After Annealing. II. Metallo-Physical Researches.** Friedrich Erdmann-Jesnitzer. *Neue Hütte*, v. 1, no. 8, Sept. 1956, p. 477-486.

Comparison of the phenomena in aging of steel with age hardening of duralumin. Variation of mechanical strength values including notched-bar impact strength of cold worked steels by means of annealing. (J23, J27, Q general; AY)

7-J. (German.) **Effect of Rim Decarburization in End Quench Hardenability Test of Steels.** Adolf Rose and Leo Rademacher. *Stahl und Eisen*, v. 76, no. 21, Oct. 18, 1956, p. 1366-1369.

Degree of rim decarburization, effect of quenching temperature and composition of steel. Cooling rates. (J4a, 18-1; ST)

8-J. Continuous Salt Bath Treatment Improves Farm Tools. *Industrial Heating*, v. 23, Nov. 1956, p. 2320 + 5 pages.

To minimize warpage and obtain optimum physical properties, tools are isothermally heat treated in a modern automatic electric salt bath installation. (J2j, T3)

9-J. Simplified Heat Treatment of Piston Pins in Rotating Retort Furnace. R. E. Haislip. *Industrial Heating*, v. 23, Nov. 1956, p. 2333 + 5 pages.

Gas carburizing, rotating retort furnace, endothermic atmosphere, quality control. (J28g, J2k, W27; ST)

10-J. How Measurements Lead to Effective Quenching. Victor Paschkis and George Stolz, Jr. *Iron Age*, v. 178, Nov. 22, 1956, p. 95-97.

Effectiveness of an agitated quench, still water, quenching in brine. (J2m)

11-J. Controlled Atmospheres in Heat Treating. C. W. Sanzenbacher. *Iron and Steel Engineer*, v. 33, Nov. 1956, p. 71-76.

Types of prepared atmospheres, equipment required to generate them, applications in the steel industry. (J2k; ST)

12-J. Induction Hardening Operations on Crankshafts. *Machinery, (London)*, v. 89, Nov. 16, 1956, p. 1122-1125.

Equipment and procedures. (J2g; ST)

13-J. Annealing With Superfast Cooling Option. Lester E. Alban and Harrold J. Bates. *Steel*, v. 139, Dec. 3, 1956, p. 150-152.

Cycle annealing furnace will continuously handle forgings in a wide assortment of sizes, shapes and alloys. (J23, W27; ST, 4-1)

14-J. The Range of Steels. J. D. Gilchrist. Paper from "Chemical Engineering Practice". v. II. Academic Press. p. 144-175.

Properties and heat treatment of various types of steel. (J general, Q general; ST)

15-J. (French.) **Induction Tempering for More Wear Resistance in Heat Engines and Machines.** G. W. Senlen. *Métallurgie et la Construction Mécanique*, v. 88, no. 10, Oct. 1956, p. 823 + 6 pages.

Principles and effects of induction tempering; properties of steels suitable for tempering. (J29, J2g; ST)

16-J. (Polish.) **Decarburizing Steel Wire.** Jozef Pechanski. *Hutnik*, v. 23, no. 9, Sept. 1956, p. 330-336.

Theory and mathematical analysis of the process, determination of the degree of decarburization, effects of furnace atmosphere. (J4a; ST, 4-11)

17-J. (Russian.) **Improvements in the Annealing of Transformer Steel.** N. F. Dubrov, G. A. Zykov and V. A. Koroleva. *Metallurg*, no. 10, Oct. 1956, p. 27-28.

Suggests redesign of the tunnel-type furnace to secure a lower temperature gradient and a more uniform annealing along the height of piled transformer steel. (J23, ST)

18-J. (French.) **Low-Alloy Heat Resistant Steels and Their Thermal Treatment.** G. Delbart and A. Constant. *Institut de Recherches de la Sidérurgie, Publications. ser. A*, no. 153, Oct. 1956, 16 p. (Rreprinted from "Metaux-Corrosion-Industries" no. 370, June 1956, p. 251-264.)

These steels, used in aircraft industry and steam plants, receive various heat treatments. Influence of these treatments on creep, relation between creep and secondary hardening. Use is limited by low resistance to oxidation. Various coatings are possible. (J general, Q23d; AY, SS-h)

19-J. (German.) **Further Development of the End-Quench Test for Testing the Hardenability of Deep-Hardening Steels.** Adolf Rose and Leo Rademacher. *Stahl und Eisen*, v. 76, no. 23, Nov. 15, 1956, p. 1570-1573.

The above is related to the time-temperature transformation diagram for continuous cooling. Application to hot working toolsteels. (J26, 18-1, N8g; TS)

20-J. (Russian.) **Effects of Heat Treatment on the Properties of Low-Carbon Rimmed Steel.** M. V. Pridantsev and Kh. Sh. Levinzon. *Stal'*, v. 16, no. 11, Nov. 1956, p. 1006-1015.

Heat treating rimmed, low carbon steels at high cooling rates makes it possible to obtain practically nonaging metals with improved physical-mechanical properties which are satisfactory substitutes for killed steel and considerably cheaper. (J general, P general, Q general; ST, CN)

K Assembling and Joining

1-K. Current Trends in Welding Steel Castings. W. H. Rice. *Foundry*, v. 84, Nov. 1956, p. 120-125.

Advances in welding are rapidly being adopted by the steel foundry industry. These processes include inert-gas and semi-automatic submerged arc welding and metallic arc welding with iron-powder-coated and low-hydrogen types of electrodes. (K1; ST, 5-10)

2-K. Chill-Shunt Tooling in Tungsten Arc Welding. Harlan L. Meredith. *Modern Machine Shop*, v. 29, Nov. 1956, p. 114-117.

Details of chill-shunt theory and

Miller Phosphor Bronze is consistently chosen for the tough jobs—in this instance a switch part that must withstand an estimated 750,000 "on and offs" without fatigue or fracture.

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Shuralev and S. G. Nekrasov. *Stal'*, v. 16, no. 11, Nov. 1956, p. 997-999.

A method was developed for accurate rolling of sections with sharp corners and flat faces. Discussion of changes made in equipment and rolling procedures. (F23; ST)

Secondary Mechanical Working

Forming and Machining

1-G. (Dutch.) **Problems in Deep Drawing Research.** J. H. Zaat. *Metaalinstituut T. N. O.*, no. 41, June 1956, 8 p.

Discusses why, where and how deep drawing research should be carried out. (G4, A9)

2-G. **Plate Bending by Rolling. Uses of Various Types of Machines.** E. L. Tinley. *Engineering*, v. 182, Nov. 16, 1956, p. 623-625.

Roll materials and roll-surface finish; working with shim-plates for irregular shapes; forms of roll drive; bending cones; dual-purpose machines adapted for bending sections; hot working of plate; flexing roll machines. (G11, W24)

3-G. **Formability of Metals. III. Press Operations.** Lester F. Spencer. *Finish*, v. 13, Dec. 1956, p. 33-35, 37.

Die clearance factor, importance of sharpness, blanking of shapes, punching and piercing, influence of bend radius, press brake forming, flanging and beading operations. (G1, 18-1)

4-G. **How Troubleshooting Makes Bending Easier.** Federico Strasser. *Iron Age*, v. 178, Dec. 6, 1956, p. 132-134.

Points to consider in locating potential trouble spots. Bending operations. (G6)

5-G. **Stretch Forming Under Fluid Pressure.** P. B. Mellor. *Journal of the Mechanics and Physics of Solids*, v. 5, Nov. 1956, p. 41-56.

An investigation into the hydrostatic bulging of circular metal diaphragms. Derivation of strain-hardening characteristics for several materials. (G14b)

6-G. **Dimpling Stainless Steel Foil.** J. E. Hagins. *Machinery (London)*, v. 89, Nov. 16, 1956, p. 1126-1127.

To avoid problems associated with wrinkling and cracking, the sheets are embossed with a pattern of dimples using an aluminum embossing die. (G3; SS, 4-6)

7-G. (German.) **Metal Cutting of Copper and Copper Alloys With Hard Metal Tools.** J. Witthoff. *Technische Mitteilungen Krupp*, v. 14, no. 5, Nov. 1956, p. 123-131.

Grinding, lapping and polishing of different types of copper and copper alloys; various phases of machining. (G18, G19, G17, T-6; Cu, 18-2)

8-G. **Shot-Peening as Protection of Surface-Damage Propeller-Blade Materials.** J. M. Lessells and R. F. Brodrick. Paper from "International Conference on Fatigue of Metals". v. III. The Institution of Mechanical Engineers. 13 p. + 2 plates.

Shot-peening, if properly controlled, considerably improves fatigue strength of subsequently damaged surfaces. Maximum improvement occurs under conditions where the depth of the compressive zone is about five times that of the gouge depth. (G23n, Q23g; ST)

9-G. (Russian.) **Cutting Steel With Oxygen in Continuous Casting Plants.** O. Sh. Spektor. *Stal'*, v. 16, no. 11, Nov. 1956, p. 1042-1048.

Details of apparatus and tech-

niques for horizontal cutting of carbon steel heated from 800 to 1200° C. (G22, D9q; CN)

10-G. (Russian.) Effect of Cold Hardening on Drawing of Heat Resistant Materials. N. F. Pronkin. *Stanki i Instrument*, v. 27, no. 10, Oct. 1956, p. 29-31.

Effect of cold hardening on machinability and strength. Experimetal data. Method and devices of investigation. (G4, G17, 18-1; SG-h)

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Details of chill-shunt theory and

its application in tooling for fusion butt welding thin-gage material. (K1, W29)

3-K. Some Nondestructive Testing Methods for Testing Welds. W. J. McGonnagle. *Welding Journal,* v. 35, Nov. 1956, p. 1110-1119.

Sensitivity, advantages, disadvantages and limitations of various methods and techniques of nondestructive testing. (S13; 7-1)

4-K. Multipower Submerged-Arc Welding of Pressure Vessels and Pipe. R. A. Kubli and H. I. Shrubsall. *Welding Journal,* v. 35, Nov. 1956, p. 1128-1135.

Advantages of high welding speeds and high deposition rates make technique attractive where larger amounts of repetitive welding are involved. Scott connection provides simplest apparatus and control system while retaining most advantages of the three-phase method. (K1, W29)

5-K. Development of a Ferritic-Austenitic Weld Joint for Steam Plant Applications. J. T. Tucker, Jr., and F. Eberle. *Welding Journal,* v. 35, Nov. 1956, p. 529s-540s.

Apparent solution to the cracking of ferritic-austenitic welded joints found in certain protective weld features and in the use of the proper type of austenitic electrodes. (K1; ST, 9-22)

6-K. Isothermal Studies on the Weld-Metal Microcracking of Arc Welds in Mild Steel. A. E. Flanigan and Z. P. Saperstein. *Welding Journal,* v. 35, Nov. 1956, p. 541s-556s.

Temperature-dependence of time required to achieve isothermal immunization against weld-metal microcracking and reasonableness of the hydrogen-retained austenite hypothesis. (K9; CN, 9-22)

7-K. New Welding Technique Cuts Failures on Tubular Goods. J. R. Gregath. *World Oil,* v. 143, Nov. 1956, p. 135-139.

Multipass welding and use of low-hydrogen electrode recommended for welding medium-carbon steels without pre or postheating. (K1, CN)

8-K. Some Problems of the Metallurgy of Semi-Automatic Welding of Stainless Steel Using Unfused Siliceous Fluxes. A. I. Akulov. *Henry Brutcher Translation No.* 3794, 8 p. (From *Avtomaticheskaya Svarka,* v. 8, no. 3, 1955, p. 50-54.) Henry Brutcher, Altadena, Calif.

Introduction of ferrosilicon into flux. Results obtained with unfused fluxes in the welding of titanium-stabilized stainless steels. (K1; NM-p, SS)

9-K. (Russian.) **On the Use of Cast Iron for Filler Metal.** A. N. Shashkov. *Svarochnoe Proizvodstvo,* no. 11, Oct. 1956, p. 1-5.

A study of cast irons used as filler metal in welding cast iron. Composition and graphitization as well as microstructure discussed. (K2, M27, N8; CI)

10-K. (Russian.) **Preventing the Formation of Pores and Cracks in Automatic Welding of Aluminum.** V. A. Savchenkov. *Svarochnoe Proizvodstvo,* no. 11, Oct. 1956, p. 9-13.

Mechanical properties of aluminum welded automatically under flux are found to be equal to those of aluminum welded in an argon atmosphere. Dependence of the formation of pores on the crystallization rate is determined. (K1; Al, 9-18, 9-22)

11-K. (Russian.) **Selecting the Procedure for Spot Welding of Interlaced Rod Structures.** V. N. Volcheko, V. F. Kosyrev and I. E. Evgen'ev. *Svarochnoe Proizvodstvo,* no. 11, Oct. 1956, p. 13-16.

Relationship between the strength of spot-welded rods and the welding procedure. Procedure is unaffected when the angle between the rods varies from 90 to 30°. (K3)

12-K. (Russian.) **Industrial Experience With Welding of Titanium.** F. E. Tret'iakov. *Svarochnoe Proizvodstvo,* no. 11, Oct. 1956, p. 22-27.

Experimental data on the weldability of technical titanium. Arc welding in argon or helium atmosphere, automatic welding under flux and contact welding provide satisfactory welds. Gas and atomic-hydrogen welding cannot be used with titanium. (K1, K3, 18-1; Ti)

13-K. (Russian.) **Methods of Testing Welded Joints in the Reinforcement of Reinforced-Concrete Structures.** A. Ia. Brodskii. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1220-1224.

Design and use of apparatus for testing strength of welded and unwelded joints of the reinforcing framework. Relation between strength of weld and length of time under current. (K9, Q23; ST)

14-K. Porosity in Nickel Welded by the Argon-Arc Process. D. R. Milner. *British Welding Journal,* v. 3, Nov. 1956, p. 542-545.

Argon gave adequate protection of the upper surface of the weld, but oxygen pick-up occurred at the underside. Hydrogen introduced with the argon resulted in elimination of porosity. (K1d, 9-18; Ni)

15-K. Constant Arc Length vs. Constant Arc Voltage. Roger W. Tuthill. *Industry & Welding,* v. 29, Dec. 1956, p. 54-56, 59, 86.

Arc length controls quality and appearance of weld. Arc voltage is convenient tool for measuring arc length. (K1)

16-K. Use Multiple-Pass Welding Techniques to Join Nickel Alloy Components. *Industry & Welding,* v. 29, Dec. 1956, p. 78-80, 82-83.

Inert-gas-shielded arc welding with small-diameter welding rod and multiple passes produces extremely sound and highly uniform welds required for Atomic Energy machinery components. (K1d; Ni)

17-K. Titanium Alloys Arc-Welded in Open Air. Ben C. Brosheer. *Metalworking Production,* v. 100, Nov. 9, 1956, p. 1819-1822.

Fusion welding of titanium alloys in the open air is practical and economical with automatc inert-gas shielded tungsten arc. Manual welding with the same arc also looks promising, but requires a very high level of "operator integrity". (K1d; Ti)

18-K. Take Six Steps to Better Brazing. *Iron Age,* v. 178, Nov. 29, 1956, p. 80-81.

Joint clearance limits brazing alloy flow, flux brushes on more quickly, spreads more uniformly and produces better fluxing action if warmed to about 90 to 100° F.: the brazing alloy flows best if joint is uniformly heated. (K8; SG-f, Ag)

19-K. (Russian.) **Welding of Austenitic Steel Rotors.** K. V. Liubavskii and V. A. Toropov. *Metallovedenie i Obrabotka Metallov,* no. 10, Oct. 1956, p. 52-56.

A study of the conditions of arc welding of rotors consisting of a few disks and two austenitic steel ends. A process was devised for welding and thermal treatment of commercial rotors. (K1, W11, AY)

20-K. The Removal of Oxide From Aluminum by Brazing Fluxes. M. F. Jordan and D. R. Milner. *Institute of Metals, Journal,* v. 85, Oct. 1956, p. 33-40 + 1 plate.

Studies carried out by the interference-fringe technique confirmed that the oxide films are not dissolved, but are detached from the surface by the flux. The film is undermined as a result of electrochemical action at the oxide-metal interface, a cell being set up between the oxide and metal. (K8; Al, NM-p)

21-K. (Czech.) **The Theory of Pressure Welding.** F. Erdmann-Jesnitzer. *Zvaranie,* v. 5, no. 8-9, Sept. 1956, p. 228-233.

The development of a theory of pressure welding which takes into consideration the most important factors of heat, time, pressure and elastic and plastic deformation. Theory agrees well with practice. (K2k, 10-1)

22-K. (Czech.) **Welding With Completely Coated, Completely Consumed Electrodes.** Vilém Hromadko. *Zvaranie,* v. 5, no. 8-9, Sept. 1956, p. 236-243.

Welding with completely coated electrodes of the type E44.72. The electrodes are lightly welded to the holder and are completely consumed. Advantages and disadvantages. (K1a, W29)

23-K. (Book.) **Observations on Weak Laps in Tinplate Can Bodies.** W. E. Hoare and J. P. Gustin. 12 p. 1954. Tin Research Institute, Fraser Road, Perivale, Greenford, Middlesex, England.

Satisfactory seam strength depends ultimately on design of the seam, control of can-fabricating operations so that designed dimensions are maintained, use of proper conditions in soldering, and use of tinplate of good soldering quality. (K7, 18-17; Sn)

24-K. (Book.) **The Weldability of High-Tensile Structural Steels.** C. L. M. Cottrell, K. Winterton, and B. J. Bradstreet. 102 p. 1956. Reprint of Ministry of Supply Report; W. R. (D) Jan. 1955, British Welding Research Association, London, England.

Concerns the problem of cold cracking in the heat affected zone of welds made in low-alloy structural steels. (K9n, 18-1; AY)

Cleaning Coating and Finishing

1-L. Electroplating on Beryllium. J. G. Beach and C. L. Faust. *Industrial Finishing (London),* v. 9, Oct. 1956, p. 173-174.

The flow sheet shows the over-all operations used to electroplate on beryllium. Eight variations in the preliminary preparation were used without noticeable effect on the adhesion. The recommended procedure contains several precautionary operations that have not been fully evaluated. (L17; Be)

2-L. Selecting Electroplates for Iron Powder Parts. W. H. Safranek and M. W. Wirth. *Materials & Methods,* v. 44, Nov. 1956, p. 104-109.

A comprehensive investigation, where specific recommendations on bath formulations and detailed data are given on appearance, thickness and uniformity, salt spray resistance and humidity resistance. (L17; Fe, 8-21, Cd, Zn, Cu, Cr, Ni)

3-L. Cleaning Metals and Alloys. C. B. F. Young. *Metal Finishing,* v. 54, Nov. 1956, p. 56-59, 65.

Alkaline cleaners, wetting agents, nonionic surface active agents, typical cleaning processes, simplifying the cleaning process. (L12; Cu, Fe, Zn, Pb, Sn)

4-L. How to Clean Die Castings Before Finishing. T. Murray. *Precision Metal Molding*, v. 41, Nov. 1956, p. 73-74.

Mechanical, solvent, and alkaline cleaning systems. (L10, L12; 5-11)

5-L. Calorizing of Gas-Turbine Blades of Austenitic Steel. V. I. Prosvirin, A. I. Fedosov and Yu. S. Myakishev. *Henry Brutcher Translation No.* 3805, 8 p. (From *Metallovedenie i Obrabotka Metallov*, v. 2, no. 4, Apr. 1956, p. 50-56.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 536-L, 1956. (L15; Al, AY)

6-L. Effect of Ultrasound Upon Electro-Deposition of Metals. A. Roll. *Henry Brutcher Translation No.* 3826, 8 p. (Abridged from *Metalloberflache*, v. 10, no. 8, 1956, p. 230-233.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 663-L, 1956. (L17, W3; Ni, Ag, Cr)

7-L. (Czech.) **Electrolytic Polishing of Metals.** Ivan Hrivnak. *Hutnické Listy*, v. 11, no. 10, Oct. 1956, p. 599-611.

Explains Jaquet-Rocquet theory and mechanism of polishing polyphase structures. (L13p)

8-L. (Dutch.) **Hard Surfacing of Wear Resistant Metal Surfaces.** P. G. Weeber, J. W. Mey and Th. Berkhout. *Smit Mededelingen*, v. 11, no. 3, July-Sept. 1956, p. 69-77.

Preferred type of hard surfacing metal, method of welding, measurement of wear resistance. (L24, Q9; SG-m)

9-L. (French.) **Porosity Dispersion in Electrolytic Coating.** Maurice Bonnemay. *Journal de Chimie Physique*, v. 53, no. 9, Sept. 1956, p. 688-690.

Experimental data permit drawing of the frequency curve characterizing the porosity distribution of an electrolytic coating. The curve is projected by an extrapolation formula as a function of the thickness. (L17; 9-18)

10-L. (French.) **The Kanigen Nickel Plating Process.** Grégoire Gutzeit. *Revue de l'Aluminium*, v. 33, no. 235, Sept. 1956, p. 804-809.

Processes give interesting results on aluminum, providing very hard and protective coatings on pieces of any shape. (L28; Al, Ni)

11-L. (German.) **Studies of the Mechanism of Brightening of Aluminum and Aluminum Alloys. II.** F. Baumann and H. Ginsberg. *Aluminium*, v. 32, No. 11, Nov. 1956, p. 706-711.

Reactions of aluminum with the Erftwerk brightening bath; chemical nature of brightened aluminum surfaces. (L13; Al)

12-L. (German.) **Structure of Sprayed Metal Layers.** A. Matting and W. Raabe. *Schweissen und Schneiden*, v. 8, no. 10, Oct. 1956, p. 369-374.

Optical, photographic and caloric determination of temperature at spraying jet; deformation and coherence in sprayed layers. (L23, X9)

13-L. (Russian.) **Proportion Between the Solution Composition and Precipitate in the Electrodeposition of Two-Component Alloys.** E. I. Akhumov and B. Ia. Rozen. *Doklady Akademii Nauk SSSR*, v. 109, no. 6, Aug. 21, 1956, p. 1149-1151.

Theoretical formulas verify the experimental data. (L17)

14-L. Properties, Specifications, Tests and Recommendations for Coal Tar Coatings. II. Cold Applied Coatings. W. F. Fair, Jr. *Corrosion*, v. 12, Dec. 1956, p. 605-610.

Surface preparation, types and characteristics of coatings; selection of primer; water vapor permeability; recommendations for protection in more corrosive atmospheres. (L26a)

15-L. The Use of Hot-Dip Strippable Coatings for the Protection of Spares. F. A. S. Wood and N. R. Kirkby. *Corrosion Technology*, v. 3, Nov. 1956, p. 355-356.

Easily applied coatings of tough, rubbery plastic give complete protection against corrosion and abrasion. (L26p)

16-L. Hardness of Electrodeposited Tin-Nickel Alloy on Brass. V. R. Ramanathan. *Institute of Metal Finishing, Bulletin*, v. 6, Autumn 1956, p. 1-7.

Hardness determined by the microindentation technique. Thickness of coating is 16 times the depth of penetration. (L17, Q29q, S14b; Cu, Sn, Ni, 8-12)

17-L. The Influence of Some Process Variables on the Reflectivity and Surface Appearance of Electrolytic Tinplate. R. Mills. *Institute of Metal Finishing, Bulletin*, v. 6, Autumn 1956, p. 8-17.

Increasing the temperature of the electrolyte and the relative cathode-electrolyte velocity results in an extension of the upper limit of current density at which acceptable coatings are produced. (L17b; Sn)

18-L. Plating of Tungsten by an Oxidation-Reduction Cycle. M. G. Charlton and G. L. Davis. *Institute of Metal Finishing, Bulletin*, v. 6, Autumn 1956, p. 28-39.

Tungsten is deposited by holding a tungsten source at high temperature in an atmosphere of hydrogen and water vapor with the body to be plated close to the tungsten and heated to above 700° C. (L25; W)

19-L. High Speed Tinning Line Has Unique Features. J. W. Brinks. *Iron and Steel Engineer*, v. 33, Nov. 1956, p. 133.

Trouble shooting in the controller is simplified through use of a new memory-type fault finder which instantly detects and remembers location of circuit faults. High power density of 200 kw. per ft., coupled with fast response scanner regulator equipment, works to assure that exactly the right amount of power is applied to the strip for flowing the tin. (L16, X10; Sn)

20-L. Batch Anodizing. M. Flusin. *Metal Industry*, v. 89, Nov. 16, 1956, p. 413-416.

Designs evolved for baskets, maintenance of satisfactory electrolyte temperature, preparatory treatment, bath conditions, drying and sealing, and arrangement of parts in the containers. (L19, 17-2)

21-L. Comparison of Finishes for Aluminum. Walter E. Pocock. *Metal Progress*, v. 70, Nov. 1956, p. 96B.

Data sheet comparing electrolytic and chemical conversion processes with regard to properties of coating, treatment and equipment. (L14, L17; Al)

22-L. Finishes for Aluminum Alloys. II. Chemical or Conversion Coatings. Walter E. Pocock. *Metal Progress*, v. 70, Nov. 1956, p. 97-101.

Coatings formed by chemical reaction of aluminum with chromate solutions provide excellent resistance to corrosion and good bases for paint. They are inexpensive to produce and have replaced anodic coatings in many applications. (L14c; Al)

23-L. Sodium Hydrides Descaling Process. W. F. S. Taylor. *Metal Treatment and Drop Forging*, v. 23, Nov. 1956, p. 465-468.

Principles and applications of descaling equipment. (L12n)

24-L. (German.) **Cold Galvanizing With Zinc Dust Pastes.** K. Zimmermann. *VDI Zeitschrift*, v. 98, no. 30, Oct. 1956, p. 1727-1728.

Protection against corrosion by coating with this commercial zinc-paste (94% zinc-dust). (L29; Zn)

25-L. Electrolytic and Chemical Methods of Metal Brightening. H. Silman. *Birmingham Metallurgical Society, Journal*, v. 37, Sept. 1956, p. 417-430.

Theoretical considerations, tanks and racks, applications, methods used on stainless steels, chromium iron and aluminum. (L12, L13,p; SG-g, SS, Al)

26-L. Nickel Electroforming. Dodd S. Carr. *Plating*, v. 43, Dec. 1956, p. 1422-1429.

Design, fabrication and preparation of molds, selection of plating solution, building up nickel on the mold, improvement in plating baths, mold removal, machining and grinding, applications. (L18, Ni)

27-L. (Czech.) **Mechanical Descaling of Wire.** Stanislav Hajek. *Hutnik*, v. 6, no. 9, Sept. 1956, p. 271-275.

Descaling by pickling is being replaced by mechanical descaling. Description of various mechanical descaling equipment. Economic considerations. (L10, W2; ST, 4-11)

28-L. (German.) **Chemical Polishing of V2A-Steel With Gases.** G. Schmid, E. Maurer and H. Steinhausen. *Metalloberfläche*, v. 10, no. 10, Oct. 1956, p. 289-295.

Application of nitrogen dioxide, hydrogen chloride and steam for steel polishing. Optimum procedures and temperature. (L12j; ST)

29-L. (German.) **Processes During Chemical and Anodic Polishing of Metal Surfaces.** Helmut Brünner. *Metalloberfläche*, v. 10, no. 10, Oct. 1956, p. 295-299.

Requirements of electrolytes for polishing, comparison of chemically polished and electrochemically polished surfaces. Practical applications. (L12, L13p)

30-L. (German.) **Investigation of the Anodic Process of Aluminum Electropolishing by Means of Perchloric Acid-Alcohol Electrolytes.** V. Hansen and E. Knuth-Winterfeldt. *Metalloberfläche*, v. 10, no. 10, Oct. 156, p. 229-300.

Experimental findings and two hypotheses of the reaction mechanism. (L13p; Al)

31-L. (German.) **Protection of Metal Surfaces by Coatings.** R. Endres. *Metalloberfläche*, v. 10, no. 11, Nov. 1956, p. 321-326.

The need for anticorrosive coating of iron and steel structures. Physically and chemically drying paints, their properties and effects. Preparation of the metal surface before coating. Painting methods. (L26n; ST)

32-L. (German.) **Making and Testing Silvered Copper Wires.** A. Keil. *Metalloberfläche*, v. 10, no. 11, Nov. 1956, p. 327-329.

Advantages and disadvantages of dip coating and other methods. Adherence and other coating properties. (L16, L17; Ag, Cu, 4-11)

33-L. (Russian.) **Galvanic Plating of Radiation Tubes With a Lead-Tin Alloy.** S. L. Voskoboinik. *Vestnik Mashinostroenia*, v. 36, no. 10, Oct. 1956, p. 59-60.

New method eliminates health hazards and forms a high-quality plating. (L17, A7; Pb, Sn)

34-L. (Book.) **Metallizing Bibliography.** 35 p. 1956. American Welding Society, 33 West 39 Street, New York 18, N. Y.

References are primarily on equipment, process, application, testing, theory, and cost. (L23, L24; Sn, Pb, Zn)

35-L. (Book.) **Some Recent Advances in Tinplate Manufacturing Processes.** W. E. Hoare. 27 p. 1955. Tin Research Institute, Fraser Road, Perivale, Greenford, Middlesex, England.

Characteristics of steel base; annealing; electrolytic and hot-dip tinning; coating weights; tinplate in coil; testing methods.
(L16, L17,J23; Sn, ST)

36-L. (Book.) **Surface Treatment and Finishing of Aluminum and Its Alloys.** S. Wernick and R. Pinner. 580 p. 1956. Robert Draper Ltd., 85 Udney Park Road, Teddington, Middlesex, England. $11.75.

Includes information on protective and decorative finishes, such as anodizing, dyeing, electrodeposition, and conversion coatings, mechanical surface treatments and finishes, electrolytic and chemical polishing, cleaning, hard chromium plating, organic finishing, vitreous enameling, and metal spraying. (L general; Al)

37-L. (Book.) **Vacuum Deposition of Thin Films.** L. Holland. 541 p. and 25 plates. 1956. John Wiley & Sons, 440 Fourth Ave., New York, N. Y. $10.00.

Plant design, film production, and physical properties of thin films.
(L25; 14-12)

38-L. (Book—German.) **Anodic Oxidation of Aluminum.** Walther W. G. Hübner and A. Schiltknecht. 407 p. 1956. Aluminium-Verlag, Düsseldorf.

A handbook based on practical experience, including useful information on chemical and electropolishing, dyeing, equipment and its use, and grinding in preparation for oxidation. (L19, L12, L13; Al)

Metallography

Constitution and Primary Structures

1-M. The Constitution of Delta-Phase Alloys of the System Uranium-Molybdenum-Titanium. Henry A. Saller, Frank A. Rough, Arthur A. Bauer and J. Robert Doig. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-1134, Sept. 1956, 16 p.

Phase relationships between the delta phases of the uranium-molybdenum and uranium-titanium systems presented on the basis of thermal-analysis data obtained and metallographic and X-ray examination of heat treated and quenched specimens. (M24; U, Ti, Mo)

2-M. Metallography as an Aid to Electrodeposition. A. Comley. *Electroplating and Metal Finishing,* v. 9, Nov. 1956, p. 355-361.

Metallographic techniques, their application to problems such as roughness, nodules, pits and other defects, laboratory layout.
(M general; 8-12, 9-21)

3-M. The Constitution of Tin-Indium Alloys in the Range 0-30 Per Cent Indium. J. C. Blade and E. C. Ellwood. *Institute of Metals, Journal,* v. 85, Sept. 1956, p. 30-32.

Equilibrium relationships at the tin-rich end of the tin-indium diagram; 8% of indium is soluble in tin at 205° C. and about 6% at 50° C. (M24; Sn, In)

4-M. Debye Characteristic Temperatures of Certain Noncubic Crystals. D. D. Betts, A. B. Bhatia and G. K. Horton. *Physical Review,* v. 104, ser. 2, Oct. 1, 1956, p. 43-47.

Characteristic temperatures of representative hexagonal, tetragonal and trigonal crystals evaluated by an expansion of the integrand involved in terms of harmonic polynomials, having the same symmetry as the corresponding Christoffel equations of elasticity theory. (M26)

5-M. Measurement and Calculation of Ferrite in Stainless-Steel Weld Metal. W. T. DeLong, G. A. Ostrom and E. R. Szumachowski. *Welding Journal,* v. 35, Nov. 1956, p. 521s-528s.

MagneGage is a useful and reliable instrument for measurement of ferrite if properly used on as-welded specimens. New constitution diagram for stainless-steel weld metal. (M23, M24, SS)

6-M. Fracture Grain Size, Austenite Grain Size, and Martensite Structure. B. D. Enlund. *Henry Brutcher Translation No.* 3207, 3 p. (From *Jernkontorets Annaler,* v. 134, no. 11, 1950, p. 553-555.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 64-M, 1951.
(M27; CN)

7-M. X-Ray Study of Structure of Chips Obtained in Metal Cutting. S. I. Gubkin and L. T. Mendeleev. *Henry Brutcher Translation No.* 3311, 5 p. (From *Doklady Akademii Nauk SSSR,* v. 95, no. 1, 1954, p. 73-74.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 219-M, 1954.
(M27, G17; Cu, Al, ST, Zn)

8-M. Alloys of Chromium With Platinum, Iridium, Rhodium, and Ruthenium. E. Raub and W. Mahler. *Henry Brutcher Translation No.* 3821, 15 p. (From *Zeitschrift Metallkunde,* v. 46, no. 3, 1955, p. 210-215.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 158-M, 1955.
(M24, P general; Cr, Pt, Ir, Rh, Ru)

9-M. (English.) **A Note on the Determination of Crystal Orientations by the Back-Reflection Laue Method.** Jiro Watanabé. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 8, no. 5, Oct. 1956, p. 385-390.

Crystal orientation is determined by calculating the inclination of the specimen axis to known crystal planes or zone axes which develop sharp spots or hyperbolas in photographs. (M22; Fe, Zn, Bi, Sn)

10-M. (Dutch.) **Geometric Description of Dislocations.** W. G. Burgers. *Metalen,* v. 11, no. 20, Oct. 31, 1956, p. 451-457.

Dislocations of the "line", "screw", "edge" and "incomplete" types are related by "Burgers vector".
(M26b; Co)

11-M. (French.) **Developing Polygon Formation in Iron by the Interferential Phase Method.** Georges Cizeron and Pierre Coulomb. *Comptes Rendus,* v. 243, no. 15, Oct. 8, 1956, p. 1037-1040.

An electrolytically polished surface, observed by the interferential phase method, revealed sub-links of polygon formation in ions in various states of impurities and after various treatments. (M25; Fe)

12-M. (Russian.) **The Effect of the Type of "Carburetor" Smelting on the Macrostructure of Cast Steel.** P. G. Vinnichenko. *Liteinoe Proizvodstvo,* no. 9, Sept. 1956, p. 21-22.

Compares crystallization in steels melted by the "carburetor" process with ferromanganese in one case and with manganese ore in the other. The first type shows crystallization of a more pronounced dendritic nature.
(M28h, N12; AD-n, AD-s, ST)

13-M. Dislocations and Plastic Flow in Germanium. Earl S. Greiner and William C. Ellis. *Bell Laboratories Record,* v. 34, Nov. 1956, p. 403-406.

Conductivity studies demonstrate the introduction of other imperfections in plastic flow, and provide means for identifying the types of these imperfections and estimates of their concentrations.
(M26b, Q24; Ge)

14-M. The Determination of the Alpha Phase Boundaries of the Iron-Nitrogen System by Internal Friction Methods. R. Rawlings and D. Tambini. *Iron and Steel Institute, Journal,* v. 184, Nov. 1956, p. 302-308.

Solubility of Fe_4N in iron was determined using the internal friction method. Equilibrium was approached by nitriding for comparison with the results obtained by precipitation by Dijkstra.
(M24b, Q22; Fe)

15-M. The Palladium-Tritium System at Low Temperature. R. M. Haag and F. J. Shipko. *Knolls Atomic Power Laboratory (U. S. Atomic Energy Commission),* KAPL-1097, June 1956, 40 p.

Equilibrium was readily obtained at 0. C. Below this, production of He-3 by radioactive decomposition of tritium imposed limits upon the duration of any run, and, in conjunction with slower reaction rates, decreased precision. (M24b; Pd)

16-M. Metal Whiskers. G. W. Sears and S. S. Brenner. *Metal Progress,* v. 70, Nov. 1956, p. 85-89.

The strength of small metal whiskers is close to the theoretical value. Strength decreases as size increases although many other of the unusual properties are retained.
(M26, N2, Q23n, 14-11)

17-M. Electronic Properties of Thorium, Uranium and Plutonium. I. Atomic Energy Levels. Guy W. Lehman. *North American Aviation, Inc. (U. S. Atomic Energy Commission),* NAA-SR-1659, Nov. 1956, 19 p.

The low-lying one-electron term values and atomic wave function. Effect of spin-orbit interaction.
(M25, P10; Th, U, Pu)

18-M. Etchpits and Dislocations in Zinc Single Crystals. A. H. A. Méléka. *Philosophical Magazine,* v. 1, ser. 8, no. 9, Sept. 1956, p. 803-811.

High-purity zinc single crystals were etched in 0.1% iodine in alcohol and the distribution of the etch pits was studied.
(M26s, M26b, M20q; Zn, 14-11)

19-M. Quenching Vacancies in Platinum. F. J. Bradshaw and S. Pearson. *Philosophical Magazine,* v. 1, ser. 8, no. 9, Sept. 1956, p. 812-820.

It was found that the electric resistance after quenching was greater than its original value but that the increase could be removed by annealing at temperatures in the region of 400° C.
(M26s, P15g, J26, J23; Pt)

20-M. The Stress to Move a Free Dislocation in Alpha Iron. J. Heslop and N. J. Petch. *Philosophical Magazine,* v. 1, ser. 8, no. 9, Sept. 1956, p. 866-873.

The portion of this stress due to interaction with random carbon and nitrogen atoms is temperature-independent. At low temperatures, a very temperature-dependent portion is dominant. (M26b, Q25, 2-11; Fe)

21-M. The Metallographic View. XXVIII. Metallography of Nitrided Cases. Howard E. Boyer. *Steel Processing,* v. 42, Nov. 1956, p. 639-640.

Microstructure and hardness of an aluminum-bearing nitriding steel.
(M27, Q29; AY)

22-M. Fundamental Concepts of Matter in the Solid State. M. J. P. Musgrave. Paper from "Chemical Engi-

neering Practice". v. II. Academic Press. p. 1-67.

Shows now the variations of the mechanical properties of solids, both in degree and kind, are closely related to the fundamental crystal structure. (M26, Q general)

23-M. Alloy Equilibrium Diagrams. R. N. Parkins. Paper from "Chemical Engineering Practice". v. II, Academic Press. p. 113-142.

The basic types of structure observed in alloy systems are considered in relation to the properties of metallic materials. (M24)

24-M. (German.) **Introduction to the Science of Dislocations by Means of Symbols and Models.** E. Knuth-Winterfeldt. *Radex Rundschau,* no. 7, Oct. 1956, p. 315-326.

Introduces dislocation of edge screws and combined dislocations by means of combination models and elastic models. (M26b)

25-M. (German.) **Investigation on the Type and Distribution of Nonmetallic Inclusions in Ingots Made of Effervescent Soft Openhearth Steel.** Hubert Hoff, Heinz Lessing and Georg Masing. *Stahl und Eisen,* v. 76, no. 22, Nov. 1, 1956, p. 1442-1452 + 2 plates.

A study of inclusions isolated from 5-ton ingots by using the washing method. (M28h; ST, 5-9, 9-19)

26-M. (German.) **Grain Boundaries and Grain Boundary Matter in Commercial Ferrous Materials.** Hans-Kurt Görlich and Hermann Schenck. *Stahl und Eisen,* v. 76, no. 22, Nov. 1, 1956, p. 1479-1486.

The nature, properties and importance of grain boundaries and the matter between them in unalloyed steels. (M27f; CN)

27-M. (German.) **The Quasibinary Systems of Chromium Carbide Cr_3C_2 With the Carbides of Titanium, Tantalum and Tungsten.** O. Rüdiger. *Technische Mitteilungen Krupp,* v 14, no. 5, Nov. 1956, p. 136-139.

Determination of behavior and relationship to crystal structure; no continuous succession of solid solutions is formed. (M24; Cr, Ti, Ta, W, NO-a35)

28-M. (Russian.) **Stability of Crystalline Structure of Solid Solution HgSe-TgTe System.** O. D. Elpat'evskaia, R. A. Konikova, A. R. Regel' and I. V. Iavorskii. *Zhurnal Tekhicheskoi Fiziki,* v. 26, no. 10, Oct. 1956, p. 2154-2156.

X-ray studies of different samples. Ranges of HgTe dissociation are established by means of vacuum evaporation. (M26p; Hg, Te)

29-M. The Nature of Mechanically Polished Metal Surfaces: The Surface Deformation Produced by the Abrasion and Polishing of 70:30 Brass. L. E. Samuels. *Institute of Metals, Journal,* v. 85, Oct. 1956, p. 51-62 + 4 plates.

Certain principles are established for methods by which surfaces free from serious strains may be produced by mechanical methods of polishing. Structure suggests that fine metallographic polishing operations occur essentially by a cutting mechanism. (M20p; Cu)

30-M. The System Uranium-Palladium. J. A. Catterall, J. D. Grogan and R. J. Pleasance. *Industrial Institute of Metals, Journal,* v. 85, Oct. 1956, p. 63-67 + 2 plates.

Preparation of alloys, metallography, thermal X-ray and chemical analysis, liquids, solid solutions, the compounds UPd, UPd_3 and U_5Pd_8. (M24b; U, Pd)

31-M. Thermal Acceptors in Germanium. Harry Letaw, Jr. *Physics and Chemistry of Solids,* v. 1, Sept.-Oct. 1956, p. 100-116.

Acceptors are identified as vacancies with 2 e.v. energy of formation. Annealing of thermally introduced acceptors is described by a mechanism involving the formation of divacancies as the first step. (M26s; Ge)

32-M. Observations on the Microstructure of a Brass Containing 67 Per Cent of Copper, Subjected to Alternating Bending Stresses. P. A. Jacquet. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 6p. + 7 plates.

Microscope reveals the crystallographic lattice of grains of alpha-brass which appear on the surface, and also in the deeper layers, under the effect of alternating stresses. The cracks are the direct consequence of these disorders, and develop further on subsequent annealing. (M26, 3-16; Cu, 9-22)

33-M. Quantitative Study of Substructure Characteristics and Correlation to Tensile-Property of Nickel and Nickel Alloy. Sigmund Weissmann. *Journal of Applied Physics,* v. 27, Nov. 1956, p. 1335-1344.

Application of a method combining X-ray microscopy and diffraction analysis disclosed the co-existence of three orders of magnitude of substructural entities. These three orders are structurally interrelated and distinguished by different ranges of size, disorientation angle and lattice misalignment. (M26, Q23n; Ni)

34-M. (Czech.) **New Views on Grinding and Polishing, Especially Metallographic Polishing.** Zdenek Ministr. *Hutnik,* v. 6, no. 9, Sept. 1956, p. 257-262.

Theoretical considerations. Excellent results obtained by using diamonds dispersed in a paste. (M21p, L10b; NO-f47)

35-M. (Dutch.) **A Geometrical Description of Dislocations.** W. G. Burgers. *Metalen,* v. 11, no. 21, Nov. 1956, p. 477-482.

A study of the intersection of dislocation lines, dislocations in a closed network, incomplete cases and lattice defects. (M26b)

36-M. (French.) **A New Method to Prepare Thin Metallic Films for Electron Microscope Examination.** Noboru Takahashi and Kenji Kazato. *Comptes Rendus,* v. 243, no. 19, Nov. 5, 1956, p. 1408-1411.

A new method of obtaining the diffraction diagram and the microscopic picture of a selected portion of a specimen. Examples with various alloys. (M20r; 1-5)

37-M. (French.) **Cold Disorganization and Restoration of Aluminum Crystals Subjected to Low Tensile Stresses.** J. Caisso. *Publications Scientifiques et Techniques du Ministere de l'air,* 1956, no. 316, 46 p.

A low stress generally produces a dislocation and a more or less perfect restoration in crystals. One or the other can become predominant. According to the initial dislocation, one or two transition points are found at the beginning of the tension curve for elongation values depending upon the crystal orientation, its initial dislocation and direction of the stress. (M26, 3-16; Al)

38-M. (German.) **Copper-Lead Alloys. Consititution Diagram and Structure I. Formation of Binary Alloys.** *Metall,* v. 10, no. 21-22, Nov. 1956, p. 1023-1028.

Binary constitution diagram of copper-lead alloys of different ratios from 955 to 1020° C. (M24b; Cu, Pb)

39-M. (German.) **Examination With the Electron Microscope of Electrolytically Polished Metal Surfaces.** I. H. Poppa and H. Spähn. *Metalloberfläche* v. 10, no. 11, Nov. 1956, p. 329-335.

A study of the structure of various polished metal surfaces to determine optimum polishing procedures. (M27, M20p)

40-M. (German.) **Accurate Determination of Lattice Constants by Means of a Counter-Tube Interference Goniometer.** Hans Neff. *Zeitschrift für Angewandte Physik,* v. 8, no. 10, Oct. 1956, p. 505-507.

The counter-tube-interference-goniometer was used in connection with the Cornu method for the accurate determination of lattice constants. (M22, X4)

41-M. (Italian.) **Thermodynamic Investigations on Metallic Systems. IX. The Liquid System Zn-Bi-Pb.** Venanzio Valenti, Luigi Oleari and Mario Fiorani. *Gazzetta Chimica Italiana,* v. 86, no. 11, Nov. 1956, p. 930-941.

The electromotive method was used to detemine the sections of immiscibility at the isotherms of 440 and 520° C. for the zinc-bismuth-lead system. The three pseudo-binaries studied coincided with the corresponding lines on the diagram. (M24c; Pb, Bi, Zn)

42-M. (Book.) **Cobalt and Its Alloys.** 108 p. 1956. Battelle Memorial Institute, Columbus, Ohio.

A summary of allotropy and phase diagrams. (M24, N6p; Co)

N Transformations and Resulting Structures

1-N. Observations on Grain-Boundary Migration in Aluminium Bicrystals. K. T. Aust, E. H. Harrison and R. Maddin. *Institute of Metals, Journal,* v. 85, Sept. 1956, p. 15-16.

Rates of migration were measured at temperatures of 560, 600 and 640° C. for strain-free bicrystals having orientation differences of 55° and 85° about <110>. (N3; Al)

2-N. Phase Changes in Pile-Irradiated Uranium-Base Alloys. M. L. Bleiberg, L. J. Jones and B. Lustman. *Journal of Applied Physics,* v. 27, Nov. 1956, p. 1270-1283.

Electrical resistivity, temperature coefficient of electrical resistivity, hardness and density measurements as well as X-ray diffraction patterns indicated that the stable phases at room temperature reverted to the metastable gamma phase during irradiation. (N6, P15, P10, Q29, 2-15; U)

3-N. Effects of Growth Rate on Crystal Perfection and Lifetime in Germanium. A. D. Kurtz, S. A. Kulin and B. L. Averbach. *Journal of Applied Physics,* v. 27, Nov. 1956, p. 1287-1290.

Effects of crystal growth rate and growth direction on the density of random dislocations and on the minority carrier lifetime. (N3; Ge)

4-N. Growth of Gray Cast Iron. F. N. Tavadze and I. A. Bairamashvili. *Henry Brutcher Translation No.* 3815, 13 p. (From *Liteinoe Proizvodstvo,* 1956, no. 5, May 1956, p. 15-18.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 331-N, 1956. (N3; CI)

5-N. (English.) **On the Characteristics of Bainite Transformation.** Kazuo Tsuya. *Journal of Mechanical Laboratory (Japan),* v. 2, no. 1, 1956, p. 20-27.

Details of the characteristics observed under a hot stage microscope, qualitative interpretations of the results. (N8; AY)

6-N. (English.) **Transformations in Various Metals and Alloys Observed by**

Thermionic Emission Microscope. I. Titanium. Kenji Ikeda and Shiro Ogawa. *Science Reorts of the Research Institutes, Tohoku University,* ser. A, v. 8, no. 5, Oct. 1956, p. 391-398.

Specimens in the form of a strip were directly heated by electric current and activated by (Ba, Sr)O. Several orientations of striations were observed in an original β grain in the course of cooling. (N6, X3; Ti)

7-N. (Czech.) **Structural Stability of Alloys With High Amounts of Chromium and Carbon.** Karel Löbl, Hanus Tuma and Jaroslav Jezek. *Hutnické Listy,* v. 11, no. 10, Oct. 1956, p. 592-599.

Influence of temperature and annealing time in an alloy with 30% chromium and 3% carbon. Structure, chemical composition and morphology of carbides. (N8, 2-11, 3-17; Cr)

8-N. (French.) **Thermo-Elastic Analysis of the Transformations of Titanium.** Albert Portevin and Robert Cabarat. *Comptes Rendus,* v. 243, no. 16, Oct. 15, 1956, p. 1085-1086.

Transformations in the solid state of 99.9% titanium of density 4.49 at 20° C. (N6, Q21; Ti)

9-N. (French.) **Determination of a Kirkendall Effect in γ Phase Uranium-Zirconium Diffusion.** Yves Adda, Jean Philibert and Claude Mairy. *Comptes Rendus,* v. 243, no. 16, Oct. 15, 1956, p. 1115-1118.

Displacement of reference marks on initial interface as function of temperature and duration of diffusion. Coefficients of intrinsic diffusion determined by the Darken relationship. (N1; U, Zr)

10-N. (French.) **Abnormal Scattering of X-Rays During the Precipitation in a Nickel Alloy With 7% of Silicon.** Jack Manenc. *Comptes Rendus,* v. 243, no. 16, Oct. 15, 1956, p. 1119-1121.

Abnormal scattering appears in the first stage of precipitation as happens with other nickel alloys, especially 80-20 nickel-chromium hardened with aluminum and titanium. (N7, M22; Ni, Si)

11-N. (French.) **Effect of the Surface State and Structure on Stainless Steel Activity.** Henri Hatwell. *Revue de Métallurgie,* v. 53, no. 10, Oct. 1956, p. 729-749.

Studies the stability of the passive state of iron-chromium alloys exposed to high vacuum. "Honeycomb corrosion" described. (N15, R1; SS)

12-N. (French.) **Sensitivity to Aging of Various Steels Brought to Evidence by Simple Brinell Tests.** E. Houdremont, W. Wepner and H.-J. Wiester. *Revue de Métallurgie,* v. 53, no. 10, Oct. 1956, p. 750-756.

A simple Brinell test at a moderately elevated temperature (less than 300° C.) identifies the steels according to their sensitivity to aging. (N7, Q29, ST)

13-N. (German.) **Contemporary State of Knowledge of Austenite Transformation in Steels.** A. Rose. *Schweizer Archiv für angewandte Wissenschaft und Technik,* v. 22, no. 10, Oct. 1956, p. 305-318.

TTT-diagrams for isothermal transformation and for continuous cooling for technical alloy steels. (N8; AY, CN, TS)

14-N. (Russian.) **Low-Temperature Recrystallization in Metals.** R. I. Garber, I. A. Gindin, V. S. Kogan and B. G. Lazarev. *Doklady Akademii Nauk SSSR,* v. 110, no. 1, Sept.-Oct. 1956, p. 64-66 + 1 plate.

Study of changes occurring in the microstructure of commercial iron (0.03% carbon) and nickel deformed at the temperature of liquid nitrogen. (N5, M27; Fe, Ni)

15-N. (Russian.) **Study of the Recrystallization of Titanium and Its Alloys. II. Recrystallization Diagrams of Titanium Alloys.** Iu. A. Žot'ev, E. M. Savitskii, M. Ia. Tylkina and A. N. Turanskaia. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk,* no. 8, Aug. 1956, p. 135-138 + 1 plate.

Recrystallization diagram of an alloy based on hydride-calcic titanium with an addition of chromium. Microstructural peculiarities of this alloy deformed at various temperatures of forging and annealed after hot working. (N5; Ti)

16-N. (Russian.) **Methods of Studying the Isothermal Decomposition of Structurally Free Carbides in Cast Iron.** M. V. Voloschenko. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1194-1197.

Kinetics of carbide decomposition when cast iron specimen is protected by chromium plating and when unprotected. Microstructural changes in specimens before and after heat treatment. (N8; Cr, CI)

17-N. (Russian.) **Some Methods for Determining Recrystallization Temperatures.** G. K. L'vov. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1198-1200.

Change in coercive force and in hardness during recrystallization. Measurement by the "double-hardness" method, and the microstructural method with local deformation. Effect of heating and of silicon content. (N5, M21, M23; Fe)

18-N. Solid Solubilities and Electrical Properties of Tin in Germanium Single Crystals. F. A. Trumbore. *Electrochemical Society, Journal,* v. 103, Nov. 1956, p. 597-600.

Solubility determined from 400° C. to the melting point of germanium using conventional crystal pulling techniques and crystal growth from melts in a thermal gradient. Results confirm the electrical neutrality of tin in germanium. (N12p, P15, Sn, Ge, 14-11)

19-N. Alloy Carbides Precipitated During the Fourth Stage of Tempering. An Electron Microscopic Examination. Kehsin Kuo. *Iron and Steel Institute, Journal,* v. 184, Nov. 1956, p. 258-268.

The precipitation of minute Mo_2C, VC, and TiC 'threads' at 500-600° C. causes an increase in hardness, and their growth into needles, disks, and spheroids above 600° C. causes a decrease. (N7d, Q23a; Mo, V, Ti, NOa-35)

20-N. The Occurrence of Sigma-Phase in a High-Chromium-Nickel Steel With Particular Reference to the Influence of Silicon. L. Pryce, H. Hughes and K. W. Andrews. *Iron and Steel Institute, Journal,* v. 184, Nov. 1956, p. 289-301.

New work establishes the pronounced effect of silicon on the formation of σ by increasing both the amount of the phase and its speed of formation. (N6p; AY)

21-N. Mass Spectrometric Study of Phase Changes in Aluminum, Praseodymium, and Neodymium. Robert G. Johnson, Donald E. Hudson, Wallace C. Caldwell, Frank H. Spedding and William R. Savage. *Journal of Chemical Physics,* v. 25, Nov. 1956, p. 917-925.

A sensitive method for measuring rapidly the latent heat of vaporization or sublimation of metals of low volatility. Latent heat, melting point and phase transition temperature measurements. (N6p, P12n, P12q; Al, Pr, Nd)

22-N. The Evaporation of Impurities From Silicon. S. E. Bradshaw and A. I. Mlavsky. *Journal of Electronics,* v. 2, ser. 1, Sept. 1956, p. 134-144 + 1 plate.

Equations describing the combined effects of evaporation and segregation are derived, and the rates of evaporation of certain impurities calculated. (N16n, C general; Si)

23-N. Beta-Omega Age Hardening Means Stronger Zirconium Alloys. S. A. Robinson, J. R. Doig, M. W. Mote, C. M. Schwartz and P. D. Frost. *Journal of Metals,* v. 8, Nov. 1956, p. 1544-1545.

The β-ω phase transformation, important in many titanium alloys, was revealed in zirconium alloys. Hitherto unattainable tensile strength with adequate ductility is now feasible for certain zirconium alloys. (N7a, Q23n, Q23p; Zr)

24-N. Self-Diffusion of Iron in Molten Fe-C Alloys. Ling Yang, M. T. Simnad and G. Derge. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Nov. 1956, p. 1577-1580.

Diffusion coefficients measured by using the capillary method. Samples were autoradiographed and sectioned to insure that no significant convection occurred during the diffusion. (N1c; Fe)

25-N. Isothermal and Continuous Cooling Transformation Diagrams. G. Mayer. *Metal Treatment and Drop Forging.* v. 23, Nov. 1956, p. 451-456.

General features of isothermal transformation diagrams and their application to continuous-cooling conditions. (To be continued.) (N8g; ST)

26-N. Mechanism of Diffusion of Copper in Germanium. F. C. Frank and D. Turnbull. *Physical Review,* v. 104, ser. 2, Nov. 1, 1956, p. 617-618.

In the interstitial state solubility of copper is about 10^{-2} times less and diffusivity many orders of magnitude greater than in the substitutional state. Conversion from interstitial to substitutional is effected by lattice vacancies which are generated at free surfaces and dislocations. (N1c, M26b, M26s; Cu, Ge)

27-N. (French.) **Electron Display Study of a Cellular Structure During the Cold Working Stage and Restoration of Commercial Titanium.** M. Adrien Saulnier. *Comptes Rendus,* v. 243, no. 18, Oct. 29, 1956, p. 1319-1322.

Sheets of commercially pure titanium were obtained after annealing at 650° C. and cold working. The state between cold working and recrystallization was analyzed after further annealing. (N5, J23; Ti)

28-N. (French.) **The Autoradiagraphy by α Trajectories, Applied to the Analysis of Uranium-Zirconium Alloys and to the Study of Uranium-Zirconium Diffusion.** Henriette Faraggi, Arlette Garin-Bonnet, Yves Adda and Jean-Marie Henry. *Comptes Rendus,* v. 243, no. 18, Oct. 29, 1956, p. 1316-1319.

A study of thick layers of uranium-zirconium alloys showed a practical relationship between alpha emission and uranium content, which was applied to the study of diffusion. (N1, M23q; Zr, U)

29-N. (German.) **Hardening and Separation of Platinum-Iridium Alloys.** Ernst Raub and Werner Plate. *Zeitschrift für Metallkunde,* v. 47, no. 10, Oct. 1956, p. 688-693.

Alloys show a broad miscibility gap at lower temperatures with its highest point at approximately 975° C. and 50% iridium. At

700° C. the gap extends from 7 to 99% iridium. (N12; Pt, Ir)

30-N. (Russian.) **On the Intermediate Transformation of Austenite.** L. M. Pevzner, T. D. Kubyshkina, G. M. Rovenskii and A. I. Samoilov. *Metallovedenie i Obrabotka Metallov,* no. 10, Oct. 1956, p. 2-20.

A study of the redistribution of carbon in the process of the intermediate transformation of austenite, and of the kinetics of the ultimate stages of decomposition. The transformation was observable in all alloy steels in special diffusion conditions. (N8, N1; AY)

31-N. (Russian.) **On the Pearlite Transformation in Alloy Steel.** R. I. Entin. *Metallovedenie i Obrabotka Metallov,* no. 10, Oct. 1956, p. 20-28.

Criticism of a study of the influence of the alloying elements on the kinetics of pearlite transformation and of the structural and chemical cohesion of the phases of austenite decomposition. (N8h, 2-10; AY)

32-N. (Russian.) **On Grain Growth in Commercial Titanium During Heating.** L. N. Sokolov. *Metallovednie i Obrabotka Metallov,* no. 10, Oct. 1956, p. 34-36.

The effect of the heating temperature and soaking time on previously deformed commercial titanium. (N3, F21, 2-11; Ti)

33N. The Behaviour of Interfaces in Lightly Worked Uranium During Recrystallization. P. E. Madsen. *Institute of Metals, Journal,* v. 85, Oct. 1956, p. 71-75 + 3 plates.

The boundaries of twins and kinks in uranium appear to possess an appreciable surface energy, and on annealing they undergo alterations which would be expected from a tendency to reduce the surface area. (N5f; U)

34-N. Analysis of Ferromagnetic and Antiferromagnetic Second-Order Transitions. J. A. Hofmann, A. Paskin, K. J. Tauer, and R. J. Weiss. *Physics and Chemistry of Solids,* v. 1, Sept.-Oct. 1956, p. 45-60.

Magnetic specific-heat curves were deduced for a number of ferromagnetic and antiferromagnetic materials from their total specific-heat curves. (N11, P12r; SG-n)

35-N. (English.) **The Diffusion of Electro-Deposited Chromium Into Pure Iron.** Shigetomo Ueda. *Castings Research Laboratory, Report, Waseda University,* 1956, no. 7, p. 83-86.

Chromium-plated iron was heated in a vacuum, and the diffusion coefficient and activation energy calculated. (N1b; Cr, Fe, 8-12)

36-N. (German.) **Coarse Grain Formation in Copper With Trace Element Inclusions.** F. Erdmann-Jesnitzer and E. Vogler. *Metall,* v. 10, no. 21-22, Nov. 1956, p. 1008-1020.

Effect of iron, tin, nickel, zinc, manganese, magnesium, phosphorus and sulphur on the crystallization of pure copper at various temperatures. (N3m, 2-10; Cu)

37-N. (German.) **Hardening and Recrystallization of Copper-Cobalt and Copper-Manganese-Cobalt Alloys With High Copper Content.** K. L. Dreyer and J. Geissler. *Metall,* v. 10, no. 21-22, Nov. 1956, p. 1028-1033.

Investigation of above by measuring Vickers hardness and electric resistance at low temperature and at temperatures of 500 to 600° C. (N5, Q23a, P15g; Cu)

38-N. (German.) **On the Significance of the Dislocation Layer for the Coercive Force Theory of Recrystallized Materials.** Martin Kersten. *Zeitschrift für Angewandte Physik,* v. 8, no. 10, Oct. 1956, p. 496-502.

An attempt to derive a quantitative theory of ferromagnetic hysteresis and of coercive force of technically pure recrystallized materials from the hypothesis that the curvature of the Block wall under the pressure of the field energy is the important elementary feature. (N5f, P16)

39-N. (German.) **The Orientation of Metal Layers Deposited by Vaporization on Copper Single Crystal Surfaces —Electron Interference Examination.** Oswald Haase. *Zeitschrift für Naturforschung,* v. 11a, no. 10, Oct. 1956, p. 862-864 + 2 plates.

Surfaces of copper single crystals were electrolytically polished and then cleaned by a special process. Copper, silver, gold, palladium and zinc were vapor deposited. Resulting layer orientation observed and explained. (N15g; Cu, 14-11)

40-N. (Russian.) **The Energy of Hole Formation in Metals and Alloys.** S. D. Gertsriken. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 238-241.

Claims a superior method of calculating the energy of hole formation in diffusion processes using the entire heat curve. (N1c)

41-N. (Russian.) **Diffusion of Cobalt in Cobalt-Aluminum Alloys.** S. D. Gertsriken and I. Ia. Dekhtiar. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 242-246.

Determining the parameters of diffusion of cobalt in cobalt-aluminum alloys. (N1b; Al, Co)

42-N. (Russian.) **Diffusion Studies on the Elimination, by Heating at Elevated Temperatures, of the Traces of Martensitic Transformations.** *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 278-281.

The variation in self-diffusion as a function of the temperature and time of prediffusion heat treatment. (N1d, N6q; ST)

43-N. (Russian.) **Peculiarities in the Structure of Structural Steel in the Reversible Temper Brittleness State. I. Microstructure Studies. II. Fractographic Studies.** S. F. Iur'ev and Z. I. Kusnitsina. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 280-298 + 2 plates.

A study to determine the structural elements along which the fracture develops in steels due to temper brittleness. (M27, Q26s; ST)

44-N. (Russian.) **Nonhomogeneity of Carbon in Martensite After High-Frequency Tempering of Steel Specimens.** I. N. Kidin. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 299-305.

X-rays make possible a more accurate analysis of the carbon nonhomogeneity which is useful in explaining structural changes and properties of steel after high-frequency tempering. (N8a, J29; ST)

45-N. (Russian.) **Relationship Between the Carbon Content in Martensite and the Heating Parameters of High-Frequency Tempered Steel Specimens.** I. N. Kidin. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 306-308.

Concludes that the high degree of hardness after high-frequency tempering is determined by both the total amount of carbon in the steel and its distribution in the martensite crystals. (N8a, J29, Q23a; ST)

46-N. (Russian.) **Recrystallization Texture of Cold Drawn Steel.** Ts. N. Rafalovich. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 326-331.

Tests on two types of steel indicated that the orientation of the crystallites of the texture of recrystallization was completely identical with the orientation of the texture of the deformed matrix. (N5g; ST)

47-N. (Russian.) **The Effects of Deformation Conditions on the Tendency of Steel to Mechanical Aging.** M. I. Kurmanov. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 332-340.

The effects of aging can be reduced by reducing the nitrogen and oxygen content or by combining them into stable solution by admixtures of boron, vanadium or aluminum. (N7, 2-10; ST)

48-N. (Russian.) **The Effects of the Rate of Growth of Aluminum Single Crystals on Their Mosaic Structure.** D. E. Ovsienko and E. I. Sosina. *Fiziki Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 374-382.

Recrystallization conditions and the fine structure of aluminum single crystals. Increasing the rate of growth increases the disorientation of the mosaic blocks. (N3r, 3-17; Al)

49-N. (Russian.) **The Diffussion of Lead in Lead Telluride.** B. I. Boltaks and Iu. N. Mokhov. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 11, Nov. 1956, p. 2448-2450.

Adding lead changes conduction from hole to electron conduction. The coefficient of diffusion varies from 35 at 773° K. to 0.7 to 532° K. Diffusion process is similar to that of copper in germanium. (N1c, P15; Pb, Te)

Physical Properties

1-P. The Thermal Expansion of Aluminium at Low Temperatures as Measured by an X-Ray Diffraction Method. B. F. Figgins, G. O. Jones and D. P. Riley. *Philosophical Magazine,* v. 1, ser. 8, no. 8, Aug. 1956, p. 747-758.

Accurate determination of lattice cell dimensions. Results represent a tendency for the Grüneisen constant to increase at the lowest temperatures. (P11, M22, 2-13; Al)

2-P. The Thermal Expansion of Pure Metals and the Possibility of Negative Coefficients of Volume Expansion. J. H. O. Varley. *Royal Society, Proceedings,* v. 237, ser. A, Nov. 6, 1956, p. 413-421.

Factors controlling the volume thermal expansion of solids. The negative coefficient of volume expansion of the cubic phase in plutonium. (P11; Pu)

3-P. (English.) **Hydrogen Overpotential of ε Phases.** Namio Ohtani. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 8, no. 5, Oct. 1956, p. 399-405.

Hydrogen overpotential of silver and copper alloys measured by direct method. Cohesion is strong, bond energy is large and compressibility and effective number of free electrons per atom are small. (P15, M26; Ag, Cu)

4-P. (French.) **Resistivity in Very Thin Metallic Films.** Genevieve Darmois. *Comptes Rendus,* v. 243, no. 15, Oct. 8, 1956, p. 1024-1026.

Possible existence of a two-dimensional electronic gas between the separate particles produced by metal deposition. The Mostovetch law explains the small variations in the size of metal drops. (P15; 1-5)

5-P. (French.) **Measurement of the Hall Effect on Diamagnetic Palladium Metal Alloys.** Joseph Cohen. *Comptes Rendus,* v. 243, no. 16, Oct. 15, 1956, p. 1105-1107.

A measurement of the Hall effect to 5% was performed on these alloys and compared with the concentration of δ-electrons. (P16, P15; Pd, Re, Ag, Ti)

6-P. (French.) **Influence of Mechanical Stresses on Secondary Electron Emission of Polycrystalline Metallic Substances.** Francois Davoine and René Bernard. *Journal de Physique et le Radium,* v. 17, no. 10, Oct. 1956, p. 859-865.

Test showed that the coefficient of secondary emission *d* can grow up to 20% with nickel, gold and molybdenum under the influence of plastic deformation. The initial value of *d* is restored by annealing. (P15k, Q24; Ni, Au, Mo)

7-P. (French.) **Activity of Carbon in Liquid Iron-Carbon Solution.** André Rist and John Chipman. *Revue de Métallurgie,* v. 53, no. 10, Oct. 1956, p. 796-807.

Data for the equilibrium between carbon dioxide and carbon monoxide at 1360, 1460 and 1560° C. (P12b; Fe)

8-P. (German.) **Overvoltage Effects on Bimetallic Electrodes. I.** Willi Machu and M. G. Fouad. *Werkstoffe und Korrosion,* v. 7, no. 10, Oct. 1956, p. 560-566.

Hydrogen overvoltages on mercury, zinc, lead, cadmium, nickel and platinized platinum in acetate buffer solutions. Hydrogen overvoltages of bimetallic electrodes such as zinc-copper, lead-copper and lead-platinized platinum investigated under varying surface conditions. (P15; Hg, Zn, Pb, Cd, Ni, Pt)

9-P. (German.) **Equilibrium and Kinetic Phenomena in the Liquid Ternary Systems Au-Sd-Hg and Au-Zn-Hg.** Hermann Hartmann and Karl Schölzel. *Zeitschrift für Physikalische Chemie (Frankfurt),* v. 9, no. 1-2, Oct. 1956, p. 106-126.

Determination of temperature effect; thermodynamic data on the systems. (P12; Au, Cd, Zn, Hg)

10-P. (Russian.) **Heat Conductivity and Temperature Conductivity of Cast Irons.** B. B. Kuprovskii and P. V. Gel'd. *Liteinoe Proizvodstvo,* no. 9, Sept. 1956, p. 16-18.

Dependence of heat and temperature conductivity in cast iron on the form of its carbon constituents. (P11; CI)

11-P. (Russian.) **Effect of Insoluble Inclusions on the Viscosity of Melted Metals During Supercooling.** G. I. Goriaga and E. G. Shvidkovskii. *Moskovskogo, Universiteta, Vestnik, Serlia Fiziko-Matematicheskikh i Estestvennykh Nauk,* v. 11, no. 6, June 1956, p. 33-37.

Effect of amount of inclusions and related structural changes. Heterogeneous system and viscosity. (P10f; 9-19)

12-P. The Temperature-Dependent and Temperature-Independent Parts of the Increase of Resistance Due to Impurities in a Metal. A Simple Method of Obtaining Their Ratio. A. N. Gerritsen and J. M. L. C. Van Der Aa. *Applied Scientific Research,* v. 6, sec. A, no. 2-3, 1956, p. 191-196.

A linear relation between the average temperature coefficient of resistivity of a diluted alloy between 273 and 373° K. and the residual resistance measured below 4° K. gives a quantitative determination of the ratio between the temperature-dependent and temperature-independent parts of the increase of resistance of the base metal caused by alloying. (P15g, 2-11; Co, Ni, Cu, Fe, Au)

13-P. The Specific Heats of Cadmium and Mercury. P. L. Smith and N. M. Wolcott. *Philosophical Magazine,* v. 1, ser. 8, no. 9, Sept. 1956, p. 854-865.

Measurements at 1.3 to 20° K. (P12r; Cd, Hg)

14-P. Magnetic Domains in Evaporated Thin Films of Nickel-Iron. Charles A. Fowler, Jr., Edward M. Fryer and John R. Stevens. *Physical Review,* v. 104, ser. 2, Nov. 1, 1956, p. 645-649.

In a series of six films ranging in thickness from 20,000° A to 500° A, domain patterns were photographed in all but the thickest two. (P16c; Ni, Fe, 14-12)

15-P. Piezoresistance in Bismuth. R. W. Keyes. *Physical Review,* v. 104, ser. 2, Nov. 1, 1956, p. 665-666.

Piezoresistance phenomena are consistent with some of the multi-valley models of bismuth previously proposed. (P15; Bi)

16-P. (German.) **Effect of Plastic Deformation on the Magnetic Properties of Nickel Single Crystals. I. Plastic Stress-Strain Curve and the Fatigue Law in Magnetic Saturation.** Hermann Dietrich and Eckart Kneller. *Zeitschrift für Metallkunde,* v. 47, no. 10, Oct. 1956, p. 672-684.

The law of approach to magnetic saturation was investigated at room temperature as a function of plastic deformation of nickel single crystals of different orientation. (P16, Q24, Q25r; Ni, 14-11)

17-P. (German.) **Properties of Molten Metals. IIX. Internal Friction of Liquid Gold-Tin Alloy.** Erich Gebhardt, Manfred Becker and Konrad Köstlin. *Zeitschrift für Metallkunde,* v. 47, no. 10, Oct. 1956, p. 684-687.

Viscosity of gold-tin melts up to 70% gold and 900° C. (P10f, Q22; Au, Sn)

18-P. Some Experiments on the Determination of the Latent Heats of Transition of Titanium and Iron. T. H. Schofield. *Institute of Metals. Journal,* v. 85, Oct. 1956, p. 68-70.

Latent heats of the $\alpha \rightarrow \beta$ transition in titanium and the $\alpha \rightarrow \gamma$ transition in iron were determined by a method which depends on the constancy of the products of the rates of heating and the times of transformation, and a knowledge of the specific heats. (P12q, N6p; Ti, Fe)

19-P. Specific Heat of the Superconducting State. G. V. Chester. *Physical Review,* v. 104, ser. 2, Nov. 15, 1956, p. 883-885.

Shows that for tin, the lattice specific heat of the normal state is also present in the superconducting state. (P12r, P15g; Sn)

20-P. Resonance and Reversal Phenomena in Ferromagnetic Films. R. L. Conger and F. C. Essig. *Physical Review,* v. 104, ser. 2, Nov. 15, 1956, p. 915-923.

Experiments on evaporated films of three different alloy compositions demonstrate a predicted proportionality of the reversal time and the resonance line width. (P16e; AY, 14-12)

21-P. Thermoelectric Power of Gray Tin. A. N. Goland and A. W. Ewald. *Physical Review,* v. 104, ser, 2, Nov. 15, 1956, p. 948-953.

The measured power of *p*-type samples is analyzed into electronic and phonon contributions with Hall and electrical conductivity data. (P15h; Sn)

22-P. Residual Resistivity vs. Short-Range Order in Cu_3Au. A. C. Damask. *Physics and Chemistry of Solids,* v. 1, Sept.-Oct. 1956, p. 23-26.

Resistivity increases with increasing short-range order. (P15g, M26p; Cu, Au)

23-P. The Effect of Short-Range Order on Residual Resistivity. John B. Gibson. *Physics and Chemistry of Solids,* v. 1, Sept.-Oct. 1956, p. 27-34.

A general theory, based on the Nordheim approximation, for residual resistivity of binary solid solutions with short but no long-range order. Application to Cu_3Au and α brass. (P15g, M26p; Au, Cu)

24-P. The Electronic Properties of Nickel-Palladium Alloys. E. P. Wohlfarth. *Physics and Chemistry of Solids,* v. 1, Sept.-Oct. 1956, p. 35-38.

Available magnetic data analyzed. A series of further experimental investigations is suggested. (P15, P16; Ni, Pd)

25-P. Preliminary Electrical-Resistivity Measurements of the Nickel-Palladium Alloy System. A. I. Schindler, R. J. Smith and E. I. Salkovitz. *Physics and Chemistry of Solids,* v. 1, Sept.-Oct. 1956, p. 39-41.

Resistivity reaches a maximum at approximately 70 at. % palladium at 4.2, 77, and 300° K. Shift of the maximum from the 50-50 composition appears to be due to an *s-d* scattering component which increases with palladium content and persists down to liquid-helium temperatures. (P15g; Ni, Pd)

26-P. The Hall Effect in the Silver-Palladium Alloy System. A. L. Schindler. *Physics and Chemistry of Solids,* v. 1, Sept.-Oct. 1956, p. 42-44.

The effective number of conduction electrons calculated using a one-band model is compared with that obtained for the copper-nickel alloy system and a similarity in behavior is found. (P15; Ag, Pd)

27-P. Resistance and Paramagnetism at the Superconducting Transition. James C. Thompson. *Physics and Chemistry of Solids,* v. 1, Sept. Oct. 1956, p. 61-64.

Experiments on the longitudinal magnetization and resistance of indium rods at the superconducting transition under equilibrium conditions of large current, small magnetic field and constant temperature. (P15g, P16; In)

28-P. (English.) **Some Aspects of the Connection Between the Structure and Activities of Components in Molten Salt Mixtures.** Hakon Flood. *Svensk Kemisk Tidskrift,* v. 68, no. 10, 1956, p. 509-520.

Formulas expressing activity, application to the activity of ferrous oxide in openhearth slags and to liquidus curves in alkali halide phase diagrams, complex formation in salt melts. (P12b; GG-p, NO-a32)

29-P. (French.) **Influence of a Magnetic Field on the Electrical Resistance of Thin Nickel Plates.** Thérese Rappeneau. *Comptes Rendus,* v. 243, no. 19, Nov. 5, 1956, p. 1403-1406.

At room temperature, the electric resistance of thin evaporated nickel plates, under the influence of a magnetic field, decreases or increases according to the orientation of current-magnetization. In strong fields, the resistance decreases a little in both cases. (P15g, P16; Ni, 14-12)

30-P. (German.) **Texture and Magnetization Curve in Ferrosilicon.** Dieter Ganz and Robert Brenner. *Zeitschrift für Angewandte Physik,* v. 8, no. 10, Oct. 1956, p. 502-505.

An explanation of the difference between the magnetization curves obtained from large masses of ferrosilicon and the single crystal curves. (P16; AD-n31)

31-P. (Russian.) **Using Motion Pictures to Study the Dynamics of Domain Structure in the Crystals of Transformer Steel.** L. V. Kirenskii and V. D. Dylgerov. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 216-221.

A method of observing directly the qualitative and quantitative dynamics of domain structure as a function of field changes. (P16c, M27g, X5; AY)

32-P. (Russian.) **The Relationship Between the Magnetic Inductance of Hot Rolled Transformer Steel in Strong**

Field and the Thickness of the Sheets. B. F. Trakhtenberg. *Fizika Metallov i Metallovedenie*, v. 3, no. 2, 1956, p. 222-228.

Reducing the thickness of polycrystalline ferromagnetic material reduces the value of the magnetic induction. (P16r; AY, 4-3)

33-P. (Russian.) **Magnetic Properties of Chromium Steel SH X 15 After Different Heat Treatments.** M. N. Mikheev, I. A. Kuznetsov, V. A. Kriukova and B. M. Neizvestnov. *Fizika Metallov i Metallovedenie*, v. 3, no. 2, 1956, p. 229-237.

Effects of temperature of tempering and annealing on the magnetic, electrical and mechanical properties of the steel makes it possible to determine the mechanical properties by magnetic tests.
(P16, P15, Q general, J23, J29, 2-11; AY)

34-P. (Russian.) **The Effects of Impurities on the Electrical Properties of Lead Telluride.** T. L. Kovalchik and Iu. P. Maslakovets. *Zhurnal Tekhnicheskoi Fiziki*, v. 26, no. 11, Nov. 1956, p. 2417-2431.

Effects of various impurities on conduction of this semi-conductor. A significant increase in the concentration of free electrons is possible only by adding a double impurity, for example bromine and lead. Relation between temperature of heat treatment and the concentration of carriers. (P15g, 3-19; Pb, Te)

35-P. (Book.) **Nuclear Metallurgy.** v. III. George H. Vineyard, Donald E. Thomas, and Douglas S. Billington. 54 p. 1956. American Institute of Mining, Metallurgical, and Petroleum Engineers, 29 W. 39th Street, New York 18, N. Y.

Three papers dealing with theory and mechanism of radiation effects in metals; irradiation effects on physical metallurgical processes; and irradiation effects in reactor materials. (P18, T11, 2-15)

Q Mechanical Properties and Tests

1-Q. Frictional Characteristics and Surface Damage of Thirty-Nine Different Elemental Metals in Sliding Contact With Iron. C. L. Goodzeit, R. P. Hunnicutt and A. E. Roach. *ASME, Transactions*, v. 78, Nov. 1956, p. 1669-1676.

Surface-damage characteristics are related to the relative hardness of the metals in sliding contact, their mutual solubility and their ability to form intermetallic compounds.
(Q23f; Fe)

2-Q. Metallurgists Groom Molybdenum for High-Temperature Use. Irwin Stambler. *Aviation Age*, v. 26, Nov. 1956, p. 34-41.

Alloy content-rupture strength relationship was nonlinear; tensile strength increased with strain hardening; panel prepared under argon showed good resistance.
(Q general, 2-12; Mo)

3-Q. Ductility of Tungsten-Arc Welds in Molybdenum. Norman E. Weare, Robert E. Monroe and David C. Martin. *Battelle Memorial Institute (U. S. Atomic Energy Commission)*, BMI-1139, Oct. 1956, 30 p.

Effects of cleaning methods, sheet structure, atmosphere purity and tungsten contamination. A significant difference in bend ductility was found among welds made in different heats. (Q23p; Mo, 7-1)

4-Q. The Plastic Deformation of Aluminium and Aluminium Alloys. G. Thomas and J. Nutting. *Institute of Metals, Journal*, v. 85, Sept. 1956, p. 1-7.

Electron microscope was used to study metallography of slip in pure aluminum and aluminum alloyed with up to 7% magnesium, 5% silver and 4% copper. (Q24a, X3; Al)

5-Q. Some Observations on the Development of Face-Centered Cubic Rolling Textures. F. R. Braybrook and E. A. Calnan. *Institute of Metals, Journal*, v. 85, Sept. 1956, p. 11-14.

Measurements of copper and α-brass indicate that, while the latter is consistent with deformation by slip on planes, an additional mechanism is operative in copper.
(Q24a, Cu)

6-Q. The Effect of High and Low Temperatures on the Notched-Bar Characteristics of a Cast, High-Tensile, Beta-Brass. A. R. Bailey, R. McDonald and L. E. Samuels. *Institute of Metals, Journal*, v. 85, Sept. 1956, p. 25-29.

The Charpy figure was 28.5 ft.lb., decreasing to 11 ft.lb. at −195° C.; fractures were transcrystalline in this range, although there was a small but significant tendency to intercrystalline cracking at room temperature, which gradually disappeared as the temperature of testing was lowered. (Q23r, 2-11; Cu)

7-Q. Propagation of Cleavage Cracks in Crystals. John J. Gilman. *Journal of Applied Physics*, v. 27, Nov. 1956, p. 1262-1269.

Data on crack propagation in elastic media. For inelastic media, it is postulated that two critical velocity conditions must be satisfied or crack propagation cannot occur.
(Q26n)

8-Q. Flexibility of Zinc Coatings. H. Bablik, E. Goetzl and E. Nell. *Metal Industry*, v. 89, Nov. 2, 1956, p. 373-375.

Zinc of 99.99% purity in cast state will withstand a maximum elongation of 0.5% without rupture, electrolytic zinc about 1.0%. Sendzimir-type sheets show microscopic injury after double bends. (Q23; Zn, 8-15)

9-Q. Preliminary Study of the Fatigue of Metals in Liquid Metal Environments. J. W. Martin and G. C. Smith. *Metallurgia*, v. 54, no. 325, Nov. 1956, p. 227-232, 238.

Results of fatigue tests at room temperature on amalgamated copper alloy, and at 300° C. on mild steel and stainless steel in contact with liquid tin and liquid sodium, respectively.
(Q7; Na, Cu, CN, SS, Sn, 14-10)

10-Q. Rare Earths in Steel Castings. W. J. Jackson. *Metallurgia*, v. 54, no. 325, Nov. 1956, p. 233-238.

Rare earth additions improve ductility and impact properties, reduce susceptibility to hot tearing and increase fluidity. Both hardenability and weldability appear to be unaffected. (Q23, Q26q; EG-g, ST)

11-Q. Effect of Baking on Delayed Fracture of Electroplated Ultra High-Strength Steel. *Naval Research Laboratory*, NRL Report 4839, Oct. 1956, 18 p.

Stress-relief for chromium-plated steel was complete after baking 24 hr.; for cadmium-plated steel it was incomplete after baking 200 hr.; and for zinc-plated steel little relief was seen after 200 hr.
(Q26, J1a; ST, 8-12)

12-Q. Mechanical Properties of Aluminum Multiwave Cores. E. W. Kuenzi and V. C. Setterholm. *U. S. Department of Agriculture, Forest Products Laboratory, Report No.* 1855, Sept. 1956, 30 p.

Detailed descriptions of core materials and testing procedures, analyses of experimental data, including methods for predicting compressive strengths from basic material properties. (Q general; Al)

13-Q. Effect of Temperature on the Fracturing Behavior of Mild Steel. J. D. Lubahn. *Welding Journal*, v. 35, Nov. 1956, p. 557s-568s.

Strength, energy-absorbing capacity, ductility and amount of gradual tearing preceding brittle crack propagation by cleavage are among the fracture properties observed at various temperatures. (Q26s, 2-11; CN)

14-Q. Behavior of Hard Chromium Deposits Under Cyclic Stress. I-II. A. A. Starosel'skii and D. N. Garkunov. *Henry Brutcher Translation Nos.* 3105 and 2954, 5 p. and 3 p. (From *Vestnik Mashinostroeniya*, v. 31, no. 3, 1951, p. 33-37; and v. 32, no. 6, 1952, p. 55-56.) Henry Brutcher, Altadena, Calif.

Mechanical strength, nature of failure and strength of bond between chromium deposit and basis metal. Description of failure of light and heavy deposits. (Q23n; Cr, 8-12, AY)

15-Q. Study of Fatigue Strength of Shot Peened Specimens Under Stresses Exceeding the Fatigue Limit. M. Ya. Shashin. *Henry Brutcher Translation No.* 3145, 5 p. (From *Vestnik Mashinostroeniya*, v. 32, no. 9, 1952, p. 57-60.) Henry Brutcher, Altadena, Calif.

S-N curves representing nonstrain hardened specimens and specimens strain hardened at different speeds of the shot stream and for different times. Optimum depth of strain hardening. (Q23g, G23n; ST)

16-Q. Creep of Nodular Cast Iron. V. S. Ivanova and I. A. Oding. *Henry Brutcher Translation No.* 3767, 5 p. (From *Izvestiya Akademii Nauk SSSR, OTN*, no. 7, 1955, p. 89-92.) Henry Brutcher, Altadena Calif.

Previously abstracted from original. See item 1037-Q, 1955.
(Q3, M27; CI)

17-Q. (Czech.) **Strength Limits of Material.** Jaroslav Nemec. *Hutnické Listy*, v. 11, no. 10, Oct. 1956, p. 583-592.

Shows the development of plastic and brittle fractures by means of the energy balance and conditions which are responsible for their origin.
(Q26s)

18-Q. (Dutch.) **Internal Stresses in Metals and Their Measurement.** E. C. Smits. *Bedrijf en Techniek*, v. 11, no. 263, Oct. 6, 1956, p. 621-622.

Surveys mechanical, physical and chemical methods used in measuring stresses in metals. (Q25)

19-Q. (Dutch.) **Symposium on Testing Machines. II. Fatigue Testing Machines.** G. M. Canta. *Metaalinstituut T. N. O.* 1956, no. 45, Oct. 1956, 7 p.

Characteristics of three types of machines. (Q7)

20-Q. (Dutch.) **Brittle Fracture and Its Phenomena.** G. Salomon. *Metalen*, v. 11, no. 19, Oct. 15, 1956, p. 422-424.

Theoretical considerations on the initial stage of a fracture, from the elastic deformation to the brittle state. (Q26s)

21-Q. (Dutch.) **The Kinematic Representation of the Fracture Phenomenon.** J. Leeuwerik. *Metalen*, v. 11, no. 19, Oct. 15, 1956, p. 424-429.

The fracture phenomenon in various materials studied through stages called first and second breaking fronts. Fracture mechanism was followed through diagrams and microphotographs. (Q26)

22-Q. (French.) **Mechanical Heat Resistance of Light Alloys.** *Fonderie,* no. 128, Sept. 1956, p. 367-369.

Bibliographical data on light alloys of various life durations at high temperatures.
(Q general, 2-12; EG-a)

23-Q. (French.) **Evaluation of Strength of Steels.** M. Ros and A. Eichinger. *Revue de Métallurgie,* v. 53, no. 10, Oct. 1956, p. 757-766.

Interactions between numerous tests evaluated. (Q general; ST)

24-Q. (French.) **Hot Resistance of Titanium Alloys to Repeated Tensile Stress.** Georges Vidal. *Revue de Métallurgie,* v. 53, no. 10, Oct. 1956, p. 767-774.

Resistance to hot fatigue with repeated tensile stress is studied between 68 and 932° F. for chromium-iron, chromium-aluminum, and iron-aluminum-titanium alloys. (Q23q; Ti)

25-Q. (German.) **Method of Long-Time Creep Test in Furnace With Small Size Rods.** W. Stauffer and A. Keller. *Schweizer Archiv für Angewandte Wissenschaft und Technik,* v. 22, no. 10, Oct. 1956, p. 319-333.

Method of carrying out long-time stress-rupture tests which are more reliable than short-time fatigue tests. (Q3q)

26-Q. (German.) **Investigation of the Surface Structure Effect on Vibrational Fatigue Limit of Metal Parts.** E. Siebel and M. Gaier. *VDI Zeitschrift,* v. 98, no. 30, Oct. 1956, p. 1715-1723.

Effect of roughness depth and stress distribution for various materials. Suggestion for consideration of the roughness degree in strength calculation. (Q23g)

27-Q. (Japanese.) **Static Strength of Welded Joint (Report 1).** Shozaburo Ohta. *Journal of Railway Engineering Research (Japan),* v. 13, no. 16, Aug. 25, 1956, p. 425-448.

As a basic guide to rational design of welding, welded joints were investigated for stress distribution, breaking strength, breaking mechanism under static load.
(Q23, Q25k, K general, 18-17)

28-Q. (Russian.) **Pure Bending in Bars During Creep of the Material.** N. N. Shchetinin. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk,* 1956, no. 8, Aug. 1956, p. 37-41.

Bar is stressed by a constantly acting moment; solution of the problem of steady creep is obtained with a linearized equation of the theory of strain hardening (Q3, Cu)

29-Q. (Russian.) **Change in Structure and Mechanical Properties of Low-Alloy Steel in the Zone Around the Seam in Thermal-Cycle Welding Conditions.** L. S. Gushchina, G. N. Klebanov and M. Kh. Shorshorov. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk,* 1956, no. 8, Aug. 1956, p. 131-134.

Effect of the parameters of the thermal welding cycle on grain growth and on the hardness of austenite-decay products.
(Q general, N3; AY)

30-Q. (Russian.) **Method of Recording True Compressive-Strength Curves of a Metal.** G. E. Arkulis. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1217-1220.

Describes compression-testing equipment and compares calculated and indicated values. (Q28; Pb)

31-Q. (Russian.) **Methods of Determining Tensile Strength of Ductile Metals.** Iu. I. Likhachev. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1209-1217.

Comparison of experimental and calculated results. Tensile strength of circumferentially notched cylindrical specimens with prior low-temperature local plastic deformation. (Q27; ST)

32-Q. (Russian.) **Machine for Fatigue Testing of Coiled Cylindrical Springs and Wire.** D. A. Sveshnikov and G. P. Maslennikov. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1245-1247.

Design and operation of the apparatus; interpretation of results. (Q7; ST, SG-b, 4-11)

33-Q. Investigation of Some Niobium-Base Alloys. Stan J. Paprocki and John T. Stacy. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-1143, Oct. 1956, 16 p.

Twenty-seven alloys, containing 5 wt. % aluminum, chromium, iron, molybdenum, nickel, tantalum, tungsten, vanadium or zirconium, and with an addition of 0, 9.5, or 19.0 wt. % titanium, were examined for workability, ductility, and hardness at room temperature and 1600° F., and oxidation resistance at 1800° F. (Q23, 18-1, R2q; Cb)

34-Q. Selecting Copper and Its Alloys. IV. Mechanical Properties. *Copper & Brass Bulletin,* no. 179, Nov. 1956, p. 8-9.

Strength data for "cartridge brass, 70%" and "electrolytic tough pitch copper, hard temper". (To be continued.) (Q23n; Cu)

35-Q. Metallic Transfer in Engineering Operations. Radioactive Methods Used at Cambridge. F. P. Bowden and J. B. P. Williamson. *Engineering,* v. 182, Nov. 16, 1956, p. 619-621.

Whenever a metal is manipulated mechanically, small fragments of the tools used become torn out and embedded permanently in its surface. This form of contamination can have a profound effect on the subsequent behavior of the metal. (Q9p)

36-Q. A Slip Line Field for the Hot Rolling Process. J. M. Alexander. *Institution of Mechanical Engineers, Proceedings,* v. 169, no. 50, 1955, p. 1021-1030.

A geometrical representation of the equations defining the flow in plane strain of a plastic rigid material facilitates adjustment, by inspection, of the slip line field until both velocity and stress boundary conditions are satisfied. (Q24)

37-Q. An X-Ray Examination of Preferred Orientation and the Transformation γ-α in a Stainless-Steel Wire. K. W. Andrews. *Iron and Steel Institute, Journal,* v. 184, Nov. 1956, p. 274-286.

The austenite undergoes transformation to ferrite on cold drawing. The maximum amount of ferrite depends on the composition, but also increases towards the center of the wire. (N8j, M26c; SS, 4-11)

38-Q. The Deformation of Molybdenum Single Crystals in Compression. J. H. Hoke and R. Maddin. *Journal of the Mechanics and Physics of Solids,* v. 5, Nov. 1956, p. 26-40 + 4 plates.

Tests on 43 crystals indicate that the slip process occurs in <111> directions along zones of weakness which generally do not define a low indices plane. The position of this zone is influenced by external variables such as extraneous grains, prior deformation, and anvil or grip effect. (Q24a, Q28; Mo)

39-Q. Statistical Investigation of the Fatigue Life of Deep-Groove Ball Bearings. J. Lieblein and M. Zelen. *Journal of Research, National Bureau of Standards,* v. 57, Nov. 1956, p. 273-316.

Test data from several large manufacturers are analyzed. (Q7g, T7)

40-Q. The Influence of Design on Stress Concentration and Fatigue Failure. A. G. Gardner. *Machinery,* v. 89, Nov. 1956, p. 1061-1066.

Determination of fatigue or endurance strength; causes and alleviation of stress concentration; heat treatment stresses due to design; effect of shape on cooling speed.
(Q23g, Q25k, 18-17)

41-Q. The Mechanism of Work Softening in Aluminium. Anthony Kelly. *Philosophical Magazine,* v. 1, ser. 8, no. 9, Sept. 1956, p. 835-845.

Crystals strained at one temperature and subsequently deformed at a higher temperature show a yield point (work softening); this is accompanied by an increase in the amount of cross slip and in the intensity of cross slip traces.
(Q24c; Al)

42-Q. Low Temperature Release of Stored Energy in Cold Worked Copper. J. W. Henderson and J. S. Koehler. *Physical Review,* v. 104, ser. 2, Nov. 1, 1956, p. 626-633.

Pure polycrystalline copper and alpha-brass specimens were deformed in compression at temperatures near 185° C. Stored energy release during warmup was measured as function of temperature. (Q24, P12a; Cu)

43-Q. A General Theory of the Surface Friction of Solids. C. Rubenstein. *Physical Society, Proceedings,* v. 69, no. 441B, Sept. 1956, p. 921-933.

Theory is based on the assumptions that the adhesion theory of friction is valid and that the asperities, at which contact occurs, deform according to the law stress α (strain)^x.
(Q9p)

44-Q. Significance of Mechanical Properties and Their Measurement. P. G. Forrest and M. J. P. Musgrave. Paper from "Chemical Engineering Practice". v. II. Academic Press. p. 68-112.

The principal means of structure determination. Tests and measurements made on solids to assess mechanical properties and to relate these properties to structure.
(Q general)

45-Q. Fatigue in Metals. P. G. Forrest. Paper from "Chemical Engineering Practice". v. II. Academic Press. p. 176-208 + 2 plates.

Characteristics of fatigue failures, test methods and equipment, fatigue strength of metals, influence of stress conditions, size, surface finish and temperature, and corrosion fatigue. (Q7, Q23g, R1e)

46-Q. Creep in Metals. P. G. Forrest. Paper from "Chemical Engineering Practice". v. II. Academic Press. p. 209-241 + 1 plate.

Characteristics and measurement of creep, presentation of creep data, creep strength of ferrous and nonferrous metals, influence of metallurgical factors, stress and corrosion. (Q3, Q23d)

47-Q. (Dutch.) **A Kinematic Picture of Fracture.** J. Leeuwerik. *Metalen,* v. 11, no. 20, Oct. 31, 1956, p. 446-450.

Mechanism of fracture with ultrasonic shock waves, while traces were formed by transverse waves, in polymethylmethacrylates, glass and quartz. (Q26)

48-Q. (German.) **Electron Microscope Studies of Fractured Steel Surfaces.** Otto Werner and Johanna Hunger. *Archiv für das Eisenhüttenwesen,* v. 27, no. 10, Oct. 1956, p. 645-656.

Notch bending specimens of unalloyed structural steels were examined at time of receipt, in the normalized and aged state. Explanation of underlying structures on fractured surfaces of brittle broken crystallites. (Q26, M21e; ST)

49-Q. (German.) **Experimental Data and Suggestions for Impact Testing.** W. Spath. *Radex Rundschau,* no. 7, Oct. 1956, p. 327-333.

Designs and impact diagram from

simultaneous measurement of the impact energy and the maximum stress. (Q6)

50-Q. (German.) **Determination of Residual Stress in Aluminum, Silumin, and Brass Hollow Cylinders After Expansion.** Hans Bühler, Albrecht Häfele and Arnold Peiter. *Zeitschrift für Metallkunde,* v. 47, no. 10, Oct. 1956, p. 664-671.

Measured and computed stresses show complete qualitative correspondence in the elastoplastic range and also agree well enough quantitatively. (Q25h; Al, Cu)

51-Q. (Polish.) **The Effects of Wire Plasticity on the Fatigue Strength of Steel Wire Rope.** Zygmunt Glowacki. *Hutnik,* v. 23, no. 9, Sept. 1956, p. 336-339.

Annealing steel wire after the last drawing operation improves the mechanical properties of the wire and the rope made of it. (Q23g, J23; ST, 4-11)

52-Q. (Russian.) **On the Nature of the Reversible Temper Brittleness in Structural Steels.** S. F. Iur'ev. *Metallovedenie i Obrabotka Metallov,* no. 10, Oct. 1956, p. 37-51 + 2 plates.

Principal features of reversible temper brittleness in structural steels, intergranular development of the process, and its kinetic properties in a chilled steel. (Q23p; ST)

53-Q. (Russian.) **The Effect of Deformation Rate on the Ductility of Hardened Steel.** S. S. Shurakov. *Metallovedenie i Obrabotka Metallov,* no. 10, Oct. 1956, p. 57-63.

Tests performed on steel Z x 13 and 12 x 2 H₄A, show that ductility in hardened steels increases with a higher rate of deformation; brittleness is lessened. (Q23p, Q24, 3-17; AY)

54-Q. Hydrogen Embrittlement of Cold Worked Metals. R. L. Mills and F. J. Edeskuty. *Chemical Engineering, Progress,* v. 52, Nov. 1956, p. 477-480.

Evaluation of specimens subjected to high-pressure hydrogen at room temperature. (Q26s; AY)

55-Q. The Relation During Creep Between Grain-Boundary Sliding, Sub-Crystal Size, and Extension. D. McLean and M. H. Farmer. *Institute of Metals, Journal,* v. 85, Oct. 1956, p. 41-50.

Grain-boundary sliding was found to be approximately proportional to elongation, a slight deviation occurring in the case of copper. Relationship with subcrystal diameter was not confirmed. (Q3, M27f; Al, Cu)

56-Q. Calculation of the Contribution Made by Grain-Boundary Sliding to Total Tensile Elongation. H. Brunner and N. J. Grant. *Institute of Metals, Journal,* v. 85, Oct. 1956, p. 77-80.

Severe stress concentrations occur at the triple points whenever grain-boundary sliding takes place. An equation is derived which permits calculation of the elongation of a tensile specimen caused by sliding along any particular grain boundary. (Q27, M27f; Al)

57-Q. A New Approach to Hot Tearing. C. F. Christopher. *Journal of Metals,* v. 8, Dec. 1956, p. 1654-1657.

Impact tests and microscopic examination show that the hot tearing tendency exists in a narrow temperature range and is primarilly affected by the heterogeneous freezing point of the metals. (Q26q)

58-Q. The Fundamental Slip Process in the Torsion of a Crystal Having a Single Active Slip Plane. A. D. Whapham and H. Wilman. *Royal Society, Proceedings,* v. 237, ser. A, Nov. 20, 1956, p. 513-529 + 2 plates.

The main deformation process in the torsion of cylindrical zinc crystals consists of flexural rotational slip on (0001), when ϕ is up to 62° and probably more. This accounts for the observed saddle-like shape of the slip lamellae, and the rounded-triangular cross-section developed by the rod. (Q24a; Zn)

59-Q. (English.) **Study on High Strength Cast Iron.** Ichiro Iitaka and Kokichi Nakamura. *Castings Research Laboratory, Report, Waseda University,* 1956, no. 7, p. 13-15.

Relation between chemical composition and strength and hardness. (Q23n, Q23a, 2-10; CI)

60-Q. (English.) **The Effects of Strain Rate and Temperature on the Mechanism of Metals to Compression.** Yuji Matsuura. *Castings Research Laboratory, Report, Waseda University,* 1956, no. 7, p. 51-54.

Compression tests on 99.99% aluminum. (Q28, 2-11, 3-17; Al)

61-Q. (English.) **Fatigue of Carbon Steel by Ultrasonic Flaw Detection Method.** Hiroshi Yamanouchi and Takeshi Inukai. *Castings Research Laboratory, Report Waseda University,* 1956, no. 7, p. 55-58.

The values of the ultrasonic attenuation constant in mild steel under fatigue test vary with repeated stress intensity and stress cycle. These values increase in proportion to stress cycle, but a transition point exists on the curve. (Q7, S13g; CN)

62-Q. (English.) **Wear Properties of 60:40 Brass Containing Lead.** Fusao Hayama. *Castings Research Laboratory, Report, Waseda University,* 1956, no. 7, p. 81-82.

Variation of wear rate with speed, pressure and lead content. (Q23f; Cu, Pb)

63-Q. (English.) **The Fatigue Strength at Fluctuating Tension of Single Lap Joints of Clad 24 S-T and 75 S-T Aluminum Alloy With 2 Rows of 17 S Rivets.** A. Hartman and W. Klaassen. *Nationaal Luchtvaartlaboratorium, Rapport NLL-TNM* 2011, July 1956.

Fatigue strength of the 24 S-T alclad sheet was superior. (Q23g; Al, 8-16)

64-Q. (Dutch.) **A Theoretical Interpretation of Fracture.** F. Schwarzl. *Metalen,* v. 11, no. 21, Nov. 1956, p. 470-476.

Fracture in metal was studied in relation to the order of magnitude of the ultimate stress and cohesion energy, the influence of nonhomogeneous factors on strength, the statistical character of the ultimate stress, and time. (Q26)

65-Q. (French.) **Tensile Testing of Aluminum Alloy Castings Using Standardized Specimens on the Chevenard Micromachine.** C. Mascré. *Métaux, Corrosion-Industries,* v. 31, no. 374, Oct. 1956, p. 385-395.

Two types of tensile test specimens were proposed for standardization and comparison with classic specimens, and some mechanical characteristics of castings were examined. (Q27a, Al5)

66-Q. (German.) **Long-Time Creep Properties of Pure and Low Alloyed Copper. (Literature Review II.)** H. Vosskühler. *Metall,* v. 10, no. 21-22, Nov. 1956, p. 1020-1022.

Data for various copper alloys. (Q23d; Cu)

67-Q. (German.) **Stress Field of a Concentrated Load at the End of an Infinite Plate With an Elastic Anisotropy.** Hans H. Stadelmaier, *Zeitschrift für Angewandte Mathematik und Physik,* v. 7, no. 5, Sept. 1956, p. 393-402.

Periodic loading effects discussed and compared with an existing observation of a nonuniform stress distribution in α-iron. (Q25r; Fe)

68-Q. (Hungarian.) **Aluminum of Internationally Accepted Standard Quality. Hungarian Production Results in 1955.** Andras Domony, Robert Vassel and Janos Déry. *Kohaszati Lapok,* v. 11, no. 8, Aug. 1956, p. 369-377.

Review of laboratory and industrial experiments for the improvement of the properties of electrically conductive aluminum wire. Effects of production methods on properties. (Q general, P15g; Al)

69-Q. (Hungarian.) **Fatigue Tests of Aluminum Alloys and Their Welded Joints.** Istvan Varga. *Kohaszati Lapok,* v. 11, no. 8, Aug. 1956, p. 377-380.

Factors effecting fatigue. Optimum welding materials and procedures. (Q7, K1; Al, 7-1)

70-Q. (Russian.) **Studies of Cohesive Forces in Iron-Molybdenum Solid Solutions From Fine Structure X-Ray Absorption Spectra.** V. A. Trapetsnikov and S. A. Nemnonov. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 314-320.

Alloying iron with 2% molybdenum increases the cohesive forces; from 2% to 4% molybdenum there is no further change. (Q23n, M22g; Fe, Mo, 2-10)

71-Q. (Russian.) **The Elasticity and Plasticity Limits of Some Metals at the Temperature of Liquid Helium.** V. I. Khotkevich. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 321-325.

Thallium, indium, mercury, lead, copper, magnesium, aluminum, cadmium, tin, silver, gold, platinum, nickel, molybdenum, tantalum and iron are still plastic at the temperature of liquid helium. The electrical resistance of the metal was used to determine degree of plastic deformation of the specimen. (Q21, Q23, 2-13)

72-Q. (Russian.) **The Effects of Frequency and Amplitude of Alternating Cyclic Torsion on the Maximum Plasticity of Metals and Certain Alloys.** F. P. Rybalko, G. V. Miroliubov and N. N. Siutkin. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 341-348.

Maximum plasticity of copper, lead, tin, brass, zinc, aluminum and its zinc alloys decreases with the amplitude of the deformation. Increasing the frequency of the cycles increases the plasticity of the metals, while in the alloys it depends on the relationship of the components. (Q22n, Q23; Cu, Pb, Sn, Zn, Al)

73-Q. (Russian.) **The Size Effect in Studying Friction and Wear in Metals.** V. I. Bondar'. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 363-368.

A study of factors to be considered when making wear and friction tests. Effects of changing shape and size of specimens on the results obtained. (Q9n, Q9p)

74-Q. (Russian.) **Wear Produced by Mutual Rubbing of Similar Metals.** V. N. Kashcheev. *Fizika Metallov i Metallovedenie,* v. 3, no. 2, 1956, p. 369-373.

The body which reaches the higher temperature during the application of friction wears more slowly. The process is characterized by binding and the formation of a roughened surface. (Q9, Q23f)

75-Q. (Russian.) **Hardness and Microhardness of Ferritic Cast Iron.** K. I. Vashchenko, R. P. Todorov, and P. A. Varenik. *Liteinoe Proizvodstvo,* 1956, no. 10, Oct. 1956, p. 19-23.

Investigation of hardness of gray

and manganese cast irons and silicon steel. (Q23a; ST, CI)

76-Q. (Russian.) **Hydrogen Effect on Mechanical Properties of Steel.** P. V. Skiuev, L. I. Kvater and V. E. Shapiro. *Stal'*, v. 16, no. 10, Oct. 1956, p. 909-915.

Effect of hydrogen on plasticity and ductility of steel in relation to its chemical composition, strength, structure and testing temperature. (Q23; ST, H)

77-Q. (Russian.) **The Problem of Laminated Woody Fracture.** I. S. Kaptiug. *Stal'*, v. 16, no. 11, Nov. 1956, p. 1021-1025.

A critique of the works of several authors on the subject, citing errors made and some of the criteria for a correct evaluation. (Q26; ST)

78-Q. (Russian.) **Chemical Analysis of Surface Layers of Metals Exposed to Various Types of Wear.** B. I. Kostetskii, N. L. Golego and P. K. Topekha. *Vestnik Mashinostroeniia*, v. 36, no. 10, Oct. 1956, p. 25-26.

The role of oxygen in the hard, white surface formations of steel exposed to certain friction conditions. (Q23f, 2-10; ST)

79-Q. (Russian.) **Mechanical Properties of Steel After Impregnating Its Surface with Chromium.** G. N. Dubinin. *Vestnik Mashinostroeniia*, v. 36, no. 10, Oct. 1956, p. 56-58.

Chromium plating steel increases its long-time strength 40 to 50 times and increases fatigue strength at high temperatures. (Q23; Cr, ST, 8-12)

80-Q. (Swedish.) **Brittle Fracture in Mild Steel.** Per Matton Sjöberg. *Jernkontorets Annaler*, v. 140, no. 10, 1956, p. 759-811.

Influence of the critical strain accelleration on cleavage of ferrite. Impact test at low energy levels. Initiation and propagation of brittle fracture. Relationship between crack propagation and elastic-plastic wave propagation. Influence of residual stresses, analysis, microstructure. (Q26; CN)

81-Q. (Book.) **Fatigue of Metals and Structures.** H. J. Grover, S. A. Gordon, and L. R. Jackson, 399 p. 1956. Thames and Hudson, London W.C.1, England.

Directed particularly to the designer or engineer with some knowledge of, but limited practical experience, in fatigue problems. It is intended to provide references to published literature for more complete information on the most important items. (Q7, Q23g)

Corrosion

1-R. Attack of Unstressed Metals by Liquid Mercury. J. F. Strachan and N. L. Harris. *Institute of Metals, Journal*, v. 85, Sept. 1956, p. 17-24.

Saturated solubilities and weight losses at room temperature of most of the metallic elements in static liquid mercury determined by chemical analysis of the solutions and weighing the specimens. (R6m; Hg)

2-R. (Dutch.) **Cathodic Protection.** J. W. Boon. *Metaalinstituut T. N. O.*, no. 42, July 1956, 14 p.

Cathodic protection according to electricity and electrochemistry, the electrolytic method and the criteria of perfect protection. (R10d)

3-R. (French.) **Iron and Steel Corrosion Caused by Water.** Marcel Pourbaix. *Centre Belge d'Etude et de Documentations des Eaux*, v. 3, no. 33, 1956, p. 192-208.

Influence of pH, oxidizers, reducers, chlorides, phosphates and temperature in steel and iron corrosion; techniques for the treatment of water and metals. (R4; ST)

4-R. (French.) **Incrustation—Corrosion—Priming.** R. Rath. *Centre Belge d'Etude et de Documentation des Eaux*, v. 3, no. 33, 1956, p. 209-216.

Some problems existing in boilers at high and at very high pressure. Practical suggestions for the future. (R4c; ST)

5-R. (French.) **An Attempt at a Theoretical Interpretation of the Solubility of Metals in Water.** Jean-Charles Pariaud and Pierre Archinard. *Journal de Chimie Physique*, v. 53, no. 9, Sept. 1956, p. 765-769.

Study of a limit of solubility and of its causes. Application of the Nernst equation for various metals. (R4, P12e)

6-R. (French.) **Corrosion of Aluminum and Some Alloys in Pure Water at High Temperature.** H. Coriou, L. Grall, J. Huré, P. Lelong and J. Hérenguel. *Revue de Métallurgie*, v. 53, no. 10, Oct. 1956, p. 775-790.

Influence of previous heat processing on corrosion in water when temperature exceeds 100° C. Processes identified were growth of a continuous and protective film, simultaneous intergranular penetration and dislocation and discontinuous pitting. (R4; Al)

7-R. (German.) **Corrosion Phenomena.** Fritz Tödt. *Chemiker-Zeitung*, v. 80, no. 20, Oct. 20, 1956, p. 698-703.

Types and mechanisms of corrosion including gaseous, stress and electrochemical attack. Protection and control considered. (R general)

8-R. (German.) **Effect of Steel Structure on Its Solubility Rate in Acid.** Otto Niezoldi. *Chemiker-Zeitung*, v. 80, no. 20, Oct. 20, 1956, p. 721-723.

Concludes that corrosion behavior in hydrochloric acid is influenced by the primary crystal structure. (R6g, M27, ST)

9-R. (German.) **Corrosion Study. V. Mechanism of Chemical Passivation and Corrosion of Metals.** M. Prazak and V. Prazak. *Collection of Czechoslovak Chemical Communications*, v. 21, no. 3, June 1956, p. 564-570.

Comparison of chemical and electrochemical passivations and corrosion of iron in nitric acid of various concentrations. (R10c, R6g; Fe)

10-R. (German.) **On the Problem of Intercrystalline Corrosion as Well as Corrosion Under Tension of Homogeneous Copper-Gold and Copper-Zinc and of Precipitable Aluminum-Zinc-Magnesium Solid Solutions. I.** Heinrich Klatte. *Werkstoffe und Korrosion*, v. 7, no. 10, Oct. 1956, p. 545-560 + 2 plates.

Investigates conditions under which tensile corrosion of homogeneous mixed crystals occurs, searches for a theory for the formation of cracks. Mercury causes a decrease of tensile strength. (R2h, R1d; Au, Cu, Zn, Hg)

11-R. (Russian.) **Investigation of the Effectiveness of Cathodic Protectors Made of Aluminum-Zinc Alloys.** V. V. Gerasimov and I. L. Rozenfeld. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk*, 1956, no. 9, Sept. 1956, p. 1050-1052.

Investigation of stationary electrode potentials, magnitude of protective current, anodic polarization and stability of six alloys. (R10d, Al, Zn)

12-R. Pitting and Cracking. U. R. Evans. *Chemistry & Industry*, 1956, no. 44, Nov. 10, 1956, p. 1291-1297.

Starting places of attack, electrochemical reactions, healing and spreading, corrosion patterns on zinc and iron, pitting on aluminum, spots on tin, pitting on zinc in distilled water, pitting and dislocations, intergranular corrosion, intergranular weakening stress corrosion cracking. (R2j, R2h, R1d; Sn, Al, Zn, Fe)

13-R. Underground Aluminum Gas Line. R. S. Dalrymple. *Corrosion*, v. 12, Dec. 1956, p. 602-604.

In spite of satisfactory performance of the unprotected pipe tested, it is thought necessary to adequately coat lines in the future and to provide cathodic protection. (R8, R10d, L26; Al)

14-R. Naphthenic Acid Corrosion—An Old Enemy of the Petroleum Industry. W. A. Derungs. *Corrosion*, v. 12, Dec. 1956, p. 617-622.

Corrosion rate depends on concentration of the naphthenic acids in the oil, operating temperature, fluid velocity and activity of the acids. (R7a)

15-R. Corrosion of Type 347 Stainless Steel and 1100 Aluminum in Strong Nitric and Mixed Nitric-Sulfuric Acids. Charles P. Dillon. *Corrosion*, v. 12, Dec. 1956, p. 623-626.

Failure of stainless steel-clad tank was caused by severe vapor-phase corrosion. Replacement with aluminum was effective and economical. (R6g; SS, Al)

16-R. A High Potential Magnesium Anode. P. F. George, J. J. Newport and J. L. Nichols. *Corrosion*, v. 12, Dec. 1956, p. 627-633.

"Galvomag" will deliver from 20-30% more current to a polarized cathode than the conventional alloy anodes. Properties, composition, microstructure and field data. (R10d; Mg)

17-R. Role of Minor Elements in the Oxidation of Metals. Earl A. Gulbransen. *Corrosion*, v. 12, Dec. 1956, p. 637-643.

Various impurities are considered in terms of their effects on the physical and chemical structure of the oxide, oxide-metal interface and metal. Eight types of effects illustrated. (R1h, 3-19)

18-R. What Does Corrosion Really Cost? W. B. Hirschmann. *Corrosion*, v. 12, Dec. 1956, p. 644-646.

By taking into account the effects of taxes and the time value of money, a measure is obtained of the cost of corrosion which is credible, meaningful in relation to other costs and the net earnings of an organization. (R general, A4s)

19-R. Stress Corrosion Cracking of Monel in Hydrofluoric Acid. H. R. Copson and C. F. Cheng. *Corrosion*, v. 12, Dec. 1956, p. 647-653.

The number and path of the cracks is influenced by composition, cold work, heat treatment, stress, time and conditions of exposure. Cracking is most prone to occur where corrosion rates are high, such as in moist, aerated vapor. (R1d, R6g; Ni)

20-R. Deterrence of Hydrogen Blistering. B. W. Neumaier and C. M. Schillmoller. *Corrosion Technology*, v. 3, Nov. 1956, p. 357-361.

Major protective steps taken at fluid-unit gas plant were early removal of hydrogen sulphide and extensive water-washing starting at the fractionator overhead system. (R2n; H)

21-R. Reduction of Corrosion in Ships' Cargo Tanks by Dehumidification. H. J. Dean. *Corrosion Technology,* v. 3, Nov. 1956, p. 362-363.

Observations of six tankers indicate that dehumidification works well, provided it is supplied in adequate quantities at sufficiently frequent intervals. (R10a)

22-R. Researches on Corrosion and Inhibition. Reaction Velocity in the System Iron: Dilute Acetic Acid at 40° C. George S. Gardner, Harry L. Faigen, Gregory L. Gibson and Wilbur S. Hall. *Franklin Institute, Journal,* v. 262, Nov. 1956, p. 369-384.

Equipment and procedure devised for studying the velocity of corrosion reactions under conditions where the amounts of corrodents, both liquid and gaseous, are under careful control. Two commercial corrosion inhibitors were selected for study. (R6g, R10b; Fe)

23-R. Corrosion-Fatigue. P. T. Gilbert. *Metallurgical Reviews,* v. 1, pt. 3, 1956, p. 379-417 + 2 plates.

Corrosion-fatigue testing, characteristics, effect of variations in corrosive environments, data for various materials, relationship of failures to microstructure, electrochemical aspects, protection against corrosion-fatigue. (R1e)

24-R. Explosions of Titanium and Fuming Nitric Acid Mixtures. L. L. Gilbert and C. W. Funk. *Metal Progress,* v. 70, Nov. 1956, p. 93-96.

The probability of a pyrophoric reaction depends upon the amount of water and NO_2 in the acid. (R6g, A7p; Ti)

25-R. Corrosion-Fatigue Testing in Highly Corrosive Media. W. P. McKinnell, Jr., F. H. Beck and M. G. Fontana. *News in Engineering at Ohio State University,* v. 28, Nov. 1956, p. 28-32.

Reverse-bending fatigue-testing machine was selected for conversion to corrosion-fatigue testing. For the fuming nitric acid corrosion-fatigue tests, titanium and stainless steel were the materials whose properties were investigated. (R1e; SS, Ti)

26-R. The Action of Sodium Hydroxide Melts on Alloys of Nickel, Molybdenum, and Iron at 815° C. G. P. Smith and E. E. Hoffman. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission),* ONRL-2131, Nov. 1956, 7 p.

Reaction mechanism involves selective leaching of iron and molybdenum from solid solution with nickel and a resultant formation of subsurface porosity. Alloys containing at least 70% nickel showed more resistance to corrosion than others tested. (R6j; Fe, Ni, Mo)

27-R. Corrosion. Howard P. Kallen. *Power,* v. 100, Dec. 1956, p. 73-108.

Why metals corrode, corrosion types, combatting corrosion, testing, anticorrosion programs. (R general)

28-R. Temporary Protective Coatings for Metals. III. Corrosion Control by Cathodic Protection. E. Strong. *Product Finishing,* v. 9, Nov. 1956, p. 82-95, 128.

Electrode potentials of various metals. Theoretical aspects, current requirements, advantages of cathodic protection. (To be concluded.) (R10d)

29-R. Corrosion of Metals. F. Wormwell and E. L. Evans. Paper from "Chemical Engineering Practice". v. II. Academic Press. p. 255-341.

Principles, mechanisms, prevention. (R general)

30-R. (Czech.) Resistance of Materials Used for High-Pressure Valves Against Erosion Action of Steam. K. Löbl and F. Cerny. *Strojirenstvi,* v. 6, no. 10, Oct. 1956, p. 689-693.

Methods of testing the resistance of materials to erosion, comparison tests of various hard alloys, selection of adequate materials. (R11r, R4d)

31-R. (German.) Oxidation of Refractory Carbide Alloys. J. Hinnüber, O. Rüdiger and W. Kinna. *Technische Mitteilungen Krupp,* v. 14, no. 5, Nov. 1956, p. 140-142.

Influence of tungsten, chromium and tantalum additions on the oxidation of titanium carbide-cobalt alloys. Application to cobalt-free hard metals. Microscopic and X-ray examination of the oxide layers. (R2q, 2-10; EG-d, NO-a35)

32-R. (Russian.) Gas Corrosion of Austenitic Steels at High Temperatures. E. A. Davidovskaia and L. P. Kestel. *Metallovedenie i Obrabotka Metallov,* 1956, no. 10, Oct. 1956, p. 29-34.

Study of a series of heat resistant alloy steels relative to gas turbine installations. (R7g, 2-12; AY)

33-R. Cathodic Protection of an Active Ship Using Zinc Anodes. B. H. Tytell and H. S. Preiser. *American Society of Naval Engineers, Journal,* v. 68, Nov. 1956, p. 701-704.

High-purity zinc provided excellent protection; a useful life of four or five years is anticipated. (R10d; ST, Zn)

34-R. The Inhibition of Corrosion by Sodium Benzoate. J. H. Kaser. *Corrosion Prevention and Control,* v. 3, Nov. 1956, p. 37-40, 46.

The development and use of sodium benzoate as a corrosion inhibitor. The mechanism of such inhibition considered in the light of recent research. (R10b)

35-R. Corrosion Fatigue. A. J. Gould. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 9 p.

Testing, associated factors, methods of reducing the severity of attack. (R1e)

36-R. Corrosion Fatigue Cracking Resulting From Wetting of Heated Metal Surfaces, With Special Reference to Steam Power Plant. A. H. Goodger. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 9 p. + 6 plates.

Typical examples of cracking, conditions for cracking, mechanism of attack, effect of temperature on endurance, detection and remedial measures. (R1e, R4d)

37-R. Fatigue of Large Shafts by Fretting Corrosion. O. J. Horger. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 11 p. + 2 plates.

Fatigue resistance of press-fitted assemblies was comparatively less influenced by type of steel, tensile properties, or whether the shafts were normalized and tempered or quenched and tempered, than by subcritical quenching to obtain favorable residual thermal compressive stresses on the surface. (R1f; ST)

38-R. Fretting Corrosion and Its Influence on Fatigue Failure. A. J. Fenner, K. H. R. Wright and J. Y. Mann. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 10 p. + 4 plates.

Characteristics and mechanism of fretting, the fretting behavior of nonferrous surfaces, fretting corrosion and service failures. (R1f, Q23g)

39-R. An Investigation on the Corrosion Fatigue of Marine Propeller Shafts. Saburo Hara. Paper from "International Conference on Fatigue of Metals". v. II. The Institution of Mechanical Engineers. 6 p. + 6 plates.

Fatigue strength of small steel specimens subjected to seawater corrosion; process of origination and growth of cracks; comparison between appearance of failure in small specimens and actual propeller shafts. (R1e, R4b; ST)

40-R. (English.) On the Corrosion of Malleable Iron. Nobuhisa Tsutsumi. *Castings Research Laboratory, Report, Waseda University,* 1956, no. 7, p. 19-23.

Tests with malleable iron revealed no superior corrosion properties. (R general; CI)

41-R. (French.) Corrosion of Iron and Steel by Water. Influence of pH, Oxidizing and Reducing Agents, Chlorides, Phosphates and Temperature. Marcel Pourbaix. *Centre Belge d'Etude de la Corrosion, Rapport Technique,* no. 40, May 1956, p. 192-208.

Influence of these factors on the corrosive properties of ordinary and industrial waters in contact with iron and unalloyed steels was studied in connection with research on chemical and electrochemical equilibrium and speed of the reactions. Correct processes for anticorrosive treatment of water and metal were suggested. (R4, R10a; ST)

42-R. (German.) Corrosion, Cracking and Erosion on the Outer Surface of Copper-Alloy Condenser Tubing. II. F. W. Nothing. *Metall,* v. 10, no. 21-22, Nov. 1956, p. 1033-1038.

Stress-corrosion; cracking and corrosion. Corrosion fatigue and erosion. (R1c, R1d, R1c; Cu)

43-R. (German.) The Problems of Protection Against Corrosion and the Materials in Modern Acid Engineering. Günter Schücking. *Werkstoffe und Korrosion,* v. 7, no. 11, Nov. 1956, p. 615-626.

Methods of protection against corrosion by acids and the construction of acid-proof installations and buildings. (R6g, T26; ST)

44-R. (German.) Molybdenum in Chemical-Resistant Steels and Alloys. L. Wetternik. *Werkstoffe und Korrosion,* v. 7, no. 11, Nov. 1956, p. 628-633.

Molybdenum is used as an alloying constituent in stainless steel and alloys for extensive improvement in the chemical resistance of martensitic and ferritic stainless steels. (R6, 7; Mo, SS)

45-R. (German.) The Behavior of Materials With Regard to Fluorine. E. Lingnau. *Werkstoffe und Korrosion,* v. 7, no. 11, Nov. 1956, p. 634-641.

Resistant materials are 30% Cu nickel alloys, and for dry fluorine nonalloy steels, copper and aluminum. (R6q; Ni, Cu, ST, Al)

46-R. (German.) The Oxidation of Titanium. Per Kofstad and Karl Hauffe. *Werkstoffe und Korrosion,* v. 7, no. 11, Nov. 1956, p. 642-649.

Temperature-time relationships are established for the reaction. (R1h; Ti)

47-R. (German.) The Phenomenon of the So-Called "Phenol Corrosion" of Telephone Cables. W. Hess. *Werkstoffe und Korrosion,* v. 7, no. 11, Nov. 1956, p. 649-652.

Concludes that the biological decomposition of the jute, and not phenol, is producing the special type of corrosion. (R1g; Pb)

48-R. (German.) On the Behavior of Materials in Sulphuric Acid. Erich Rabald. *Werkstoffe und Korrosion,* v. 7, no. 11, Nov. 1956, p. 652-662.

The behavior of metals and non-

metals, influences of different additives on corrosion. (R6g, R10a)

49-R. (Italian.) **Protecting Ammonium Sulphate Crystallizers by Means of Inhibitors.** G. Roberti, F. Gianni and G. Bombara. *Metallurgia Italiana,* v. 48, no. 6, June 1956, p. 281-286.

Protective influence of 15 different materials. Copper sulphate, potassium bichromate, hydrogen peroxide and sodium arsenite develop a very good inhibiting action. (R10b)

50-R. (Polish.) **Investigation of Erosion-Corrosion Phenomena Caused by Neutral Salt Solutions Carrying Solid Suspensions.** M. Smialowski and J. Siejka. *Przemyst Chemiczny,* v. 12, no. 10, Oct. 1956, p. 569-571.

Loss in weight of two types of steel (T-45 steel of 0.10% chromium content and TR-2 steel of 1.14% Cr) was compared after rotating in solutions of sodium chloride containing suspended sand or silicon carbide. (R5c, R10r; ST)

51-R. (Russian.) **Distribution of Potential Along Piping Using Cathodic Protection.** N. A. Tsekun. *Energeticheskii Biulleten',* 1956, no. 10, Oct. 1956, p. 13-16.

A study of the divergence between theoretical calculations and practical data. Determination of the necessary corrections for existing formulas. (R10d)

52-R. (Russian.) **Passivity of Steel in Nitrose.** E. I. Litvinova. *Zhurnal Prikladnoi Khimii,* v. 29, no. 10, Oct. 1956, p. 1521-1529.

Formation of protective salt films on steel immersed in mixtures of sulphuric and nitric acids. (R10c, R6g; ST)

53-R. The Failure of a Welded Drying Drum by Caustic Embrittlement. George Sines and E. C. McLean. *Mechanical Engineering,* v. 78, Dec. 1956, p. 1105-1109.

An unusual failure caused by a design flaw and caustic embrittlement. (R1d, 18-17, 7-1)

Inspection and Control

1-S. Analyzing Aluminum Alloys. Charles Goldberg. *Foundry,* v. 84, Nov. 1956, p. 118-119.

Practical, reliable methods for determination of copper, chromium, silicon, iron, nickel and bismuth in alloys. (S11; Al)

2-S. Echo-Phantoms. Identification and Utilization in Flaw Dectection. Mohammed A. Kassem. *Iron & Steel,* v. 29, Nov. 1956, p. 503-509.

Origin of formation of echoes and their behavior; proposed rational designation of all the echoes, general echo chart for all solids. (To be concluded.) (S13; Pb, Fe, Al)

3-S. (French.) **Magnetic Examination for the Detection of Defects in Specimens and the Sorting of Steel Bars.** M. Blanchard. *Centre de Documentation Sidérurgique, Circulaire d'Informations Techniques,* v. 13, no. 10, 1956, p. 2031-2038.

Influence of defects in a metal specimen on the magnetic field. Production of magnetic fields. Use of cycles of differential permeability in sorting steel bars. Survey of various apparatus and applications. (S10r, S13j, ST)

4-S. (French.) **Properties of the Principal Metals and Alloys Produced by Swiss Metallurgical Factories.** *Pro-Metal,* v. 9, no. 53, Oct. 1956, 5 p.

A nomenclature of alloys with their commercial names, origin, composition, uses, mechanical and physical properties produced in Switzerland in 1956. (S22)

5-S. (German—French.) **Methods for the Rapid Identification of Copper Alloys.** W. Stöckli. *Pro-Metal,* v. 9, no. 53, Oct. 1956, p. 735-738.

Nondestructive electrolytic methods for rapid identification of lead, nickel, manganese and aluminum in copper alloys. (S10; Pb, Ni, Mn, Al, Cu)

6-S. (German.) **Practice in Nondestructive Testing of Welded Tubes.** H. D. Weise. *Schweissen und Schneiden,* v. 8, no. 10, Oct. 1956, p. 355-358, 360-363.

Applications of X and γ-Ray testing, and of ultrasonic methods. (S13; 7-1, 4-10)

7-S. (German.) **The Present Situation in the Classification of the Welding Processes.** H. Neuenkirchen. *Schweissen und Schneiden,* v. 8, no. 10, Oct. 1956, p. 374-378.

Classification of welding processes and their relation to present standards. (S22, K general)

8-S. (Russian.) **X-Ray Emission Spectra of Mn and Cu in Heusler Alloys Within the Range of Magnetic Transformation Temperatures.** E. E. Vainshtein and B. I. Kotliar. *Doklady Akademii Nauk SSSR,* v. 110, no. 1, Sept.-Oct. 1956, p. 44-47.

Study of shape and position of lines of the K β-band of the manganese and copper spectra in the Cu_2MnAl-type alloy in the ferromagnetic and the paramagnetic states as well as the $K\alpha_{1,2}$ lines of the same elements over a wide temperature range. (S11k, P16; Mn, Cu)

9-S. (Russian.) **X-Ray Examination of the Structural Changes Produced by Machining a Steel Surface.** O. N. Shivrin. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia,* v. 20, no. 7, July 1956, p. 736-739.

Study of the uneveness produced on the surface layers of the metal by heavy machining, of a method to raise the primary, secondary and tertiary stresses with varying parameters of the cutting capacity, and a process to relieve these stresses by tempering. (S15, G17, J29; ST)

10-S. (Russian.) **Defect Detection in Castings With the Aid of Radioactive Isotopes.** B. B. Guliaev and L. G. Demina. *Liteinoe Proizvodstvo,* 1956, no. 9, Sept. 1956, p. 18-20.

Radioactive isotopes in the use of gamma-ray radiography for defect detection in cast metals. (S13c; 5)

11-S. (Russian.) **Precipitation of Columbium and Tantalum From Titanium by Selenious Acid.** I. P. Alimarin and E. I. Stepaniuk. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1149-1153.

Selenious acid quantitatively precipitates columbium and tantalum in tartaric acid solutions containing hydrochloric acid. Solubility of titanium selenite depends strongly on temperature, so that all operations must be carried out close to the boiling point. (S11; Ta, Ti, Cb)

12-S. (Russian.) **Present State of the Analytical Chemistry of Zirconium.** V. G. Goriushina and V. M. Vladimirova. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1171-1180.

Separation of zirconium from other elements and methods for its determination. (S11; Zr)

13-S. (Russian.) **A Method of Continuous Automatic Inspection of Materials With the Aid of a Low-Frequency Ultrasonic Defectoscope.** D. I. Vasil'ev and N. F. Shustov. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1186-1188

Operation, design and efficiency of the apparatus. (S13g)

14-S. (Russian.) **Apparatus for Calibrating Tungsten-Molybdenum Thermocouples.** S. K. Danishevskii. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1235-1240.

Components of the apparatus and its accuracy. (S23; SG-a, W, Mo)

15-S. Nonferrous Metallurgical Analysis. A Review. G. W. C. Milner. *Analyst,* v. 81, Nov. 1956, p. 619-650.

Critical survey of the chemical and physico-chemical procedures available for the determination of major and minor amounts of many constituents of importance in nonferrous metallurgy. (S11; EG-a)

16-S. Determination of Copper in Steel. L. J. A. Haywood and P. Sutcliffe. *Analyst,* v. 81, Nov. 1956, p. 651-655.

Copper is complexed with biscyclohexanone oxalyldihydrazone and the resulting blue color is measured by means of the Spekker absorptiometer within the range 570 to 600 m μ. (S11a; Cu, ST)

17-S. The Polarographic Determination of Chromium in Molybdenum-Chromium Alloys. D. G. Higgs. *Analyst,* v. 81, Nov. 1956, p. 656-660.

Diffusion-current curves determined over the range −0.5 to −1.3 volts against a Hg pool and polarograms thus obtained on a damped instrument are well formed and extremely easy to read. (S11m; Cr, Mo)

18-S. How to Measure Large Dimensions. Hans W. Schmidt. *American Machinist,* v. 100, Dec. 3, 1956, p. 145-147.

Long gage bars can be combined up to 50-ft. length to avoid special single purpose gages. (S14)

19-S. Nondestructive Testing of Light Alloy Castings. V. J. Zabek. *Canadian Metals,* v. 19, Nov. 1956, p. 44, 46, 50, 52.

Methods used in Canadian foundry include fluoroscope, radiography and penetrant inspection. (S13; EG-a)

20-S. The Gravimetric Determination of Tantalum in Uranium-Tantalum Alloys. Owen H. Kriege and Ross D. Gardner. *Los Alamos Scientific Laboratory (U. S. Atomic Energy Commission),* LA-2032, Apr. 1956, 20 p.

Determination by acid hydrolysis or by precipitation with cupferron is accurate to within 1%. (S11b; Ta, U)

21-S. Quality Control of Powdered Metal Parts. G. L. Bachner. *Machinery, (London),* v. 89, Nov. 16, 1956, p. 1128-1130.

Control measures and tests used to insure uniform, dependable products. (S12g, H general; 6-22)

22-S. The Sorting of Scrap Metals and Alloys. E. Scheuer. *Metallurgical Reviews,* v. 1, pt. 3, 1956, p. 339-378 + 2 pages.

Methods and instruments for identification and sorting, sorting plan and practice, practical procedures for aluminum, copper, lead, tin, zinc and alloys. (S10)

23-S. Quality Control Through Heat Treatment. Joseph J. Warga. *Metal Progress,* v. 70, Nov. 1956, p. 78-80.

Heat treatment procedures at an aircraft parts plant where consistent high quality is required. (S general, T24)

24-S. A Complete Slag Analysis in 45 Minutes. W. T. Unfried. *Modern Castings,* v. 30, Dec. 1956, p. 32-34.

Total element present is determined and calculated to the percent of its most prominent form. Sample weights were chosen that can utilize standard laboratory solutions already prepared. (S11; NM-p, Fe, Cr, Mg, Mn)

25-S. The Use of Trialkyl Phosphine Oxides as Extractants in the Fluorometric Determination of Uranium. J. C. White. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, ORNL-2161, Nov. 1956, 24 p.

Tri-*n*-actyl and tri-*n*-decylphosphine oxides quantitatively extract uranium from solutions that are as concentrated as 12 molar with respect to such acids as sulphuric, phosphoric, and hydrochloric. (S11; U)

26-S. A Survey of Surface Finish Inspection Techniques. C. H. Good. *Steel Processing*, v. 42, Nov. 1956, p. 641-644, 648-650.

Available techniques, their limitations, advantages and applications. (S15)

27-S. (Dutch.) **Radioistopes. IV. Gamma Radiography for Nondestructive Materials Testing.** T. van der Klis. *Bedrijf en Techniek*, v. 11, no. 265; *Electronica section*, v. 9, no. 212, Nov. 1956, p. 169-173, 175.

Use of cobalt-60, cesium-137, iridium-192 and thallium-170 to determine structure and possible defects. (S13e; Co, Tl, Cs, Ir)

28-S. (German.) **Studies of the Emission Spectral Analysis of Steel With the Photo-Electrometer.** Heimar Pfundt and Hans Krempl. *Archiv für das Eisenhüttenwesen*, v. 27, no. 10, Oct. 1956, p. 629-635.

Multipliers used in the analysis were compared with photographic plates. A simple photoelectric arrangement is described. (S11n; ST)

29-S. Determination of Chloride in Titanium Sponge by the Rapid Potentiometric Method. H. V. Malmstadt, E. R. Fett and J. D. Winefordner. *Analytical Chemistry*, v. 28, Dec. 1956, p. 1878-1882.

Analysis involves a final measurement of the voltage difference between two silver-silver chloride electrodes in a concentration cell, one arm of which contains the unknown chloride solution and the other a standard chloride solution. (S11n; Ti)

30-S. Indirect Determination of Free Titanium and of Oxygen in Titanium-Oxygen Alloys by Hydrogen Evolution Method. M. E. Straumanis, C. H. Cheng and A. W. Schlechten. *Analytical Chemistry*, v. 28, Dec. 1956, p. 1883-1884.

Free titanium is calculated from the volume of hydrogen developed by the metal in hydrofluoric acid, if the sample is free from other hydrogen-developing metals. Oxygen is calculated on the basis of the lower volume of hydrogen developed in hydrofluoric acid because of the presence of oxygen in the alloys. (S11; Ti)

31-S. Flame Spectrophotometric Determination of Copper in Ferrous Alloys. John A. Dean and J. Harold Lady. *Analytical Chemistry*, v. 28, Dec. 1956, p. 1887-1889.

Copper, in the form of the salicylaldoxime complex, is selectively extracted from the aqueous solution of the sample with either chloroform or *n*-amyl acetate. (S11; Cu, Fe)

32-S. Flame Spectrophotometric Determination of Gallium in Copper-Gallium Alloys. Villiers W. Meloche and Benny L. Beck. *Analytical Chemistry*, v. 28, Dec. 1956, p. 1890-1891.

Includes effects of iron, aluminum, thallium, indium and zinc upon the emission of gallium solutions. (S11; Cu, Ga)

33-S. Spectrophotometric Method for Simultaneous Determination of Nickel and Cobalt. R. D. Whealy and S. O. Colgate. *Analytical Chemsitry*, v. 28, Dec. 1956, p. 1897-1898.

Aqueous solutions of nickelous and cobaltous nitrates react completely with excess diethylenetriamine to form solutions of colored complexes. (S11; Ni, Co)

34-S. Experimental Determination of Oxygen in Cupola-Melted Cast Iron. E. A. Loria, H. W. Lownie, Jr., and M. W. Mallett. *Journal of Metals*, v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, Dec. 1956, p. 1670-1672.

Analyses on metal and slag from melts made under normal and oxidizing conditions. From these data, relations were established between melting variables and composition of the cast iron. (S11r, E25r; CI)

35-S. Gas Content of Solid Aluminum by Solid Extraction and Vacuum Fusion. James L. Brandt and C. Norman Cochran. *Journal of Metals*, v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, Dec. 1956, p. 1672-1674.

With properly prepared specimens, reproducible hydrogen contents of aluminum alloy samples can be secured by either method. Because of the rapidity with which analyses can be obtained, vacuum fusion has a decided advantage over solid extraction. (S11r; Al)

36-S. Method for Spectrochemical Determination of Aluminum in Fe-Al Alloys. Edward F. Runge and Ford R. Bryan. *Journal of Metals*, v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, Dec. 1956, p. 1674-1676.

Procedure exhibits high precision and is adaptable to either photographic or direct reading instruments. It provides for the determination of aluminum in the concentration range between 8 and 16% and is designed for routine control purposes. (S11; Fe, Al)

37-S. A Second Look at Radiographic Inspection of Lead Linings Druing Fabrication. William Skiba. *Mechanical Engineering*, v. 78, Dec. 1956, p. 1125-1127.

Time shows that with gamma-ray inspection, defect-free homogeneously bonded lead linings can be produced. (S13e; Pb, 7-8)

38-S. Lessons To Be Learned From Failures in Service. G. A. Cottell. Paper from "International Conference on Fatigue of Metals". v. III. The Institution of Mechanical Engineers. 9 p. + 4 plates.

Causes, recognition and prevention of corrosion-fatigue and dry-fatigue. (S21, R1e, Q23g)

39-S. (French.) **Recent Progress in Using Gamma Rays for Testing Castings.** A. Blondel. *Métaux, Corrosion-Industries*, v. 31, no. 374, Oct. 1956, p. 396-406.

Light alloy specimens can be tested by artificial radioactive isotopes. Application of cobalt-60, indium 192 and thulium-192 and care of negatives in gamma-ray exposures. Cesium-137 and cerium-144 as new possible sources of radioactive isotopes. (S13e; EG-a39, 5)

40-S. (French.) **Determining Hydrogen in Liquid Steel.** M. Lacomble and A. Coune. *Revue Universelle des Mines*, v. 12, ser. 9, no. 11, Nov. 1956, p. 602-607.

The apparatus, working conditions and sampling methods used in determining hydrogen in steels. A study of the effect of sampling time on hydrogen content. (S11r; H, ST)

41-S. (French.) **Determining Phosphorus in Steels by Direct Spectrum Analysis.** A. Hans, M. Lacomble and L. Charlet. *Revue Universelle des Mines*, v. 12, ser. 9, no. 11, Nov. 1956, p. 607-613.

The spectral difficulties in determining phosphorus were overcome by using a spectrograph provided with a precision grating and other special accessories. The copper influence was eliminated and the spectral results confirmed by further chemical determination. (S11k; P, ST)

42-S. (German.) **Gamma-Rays in Material Testing.** Gunther Münch. *Giesserei*, v. 43, no. 23, Nov. 8, 1956, p. 745-750.

Nondestructive testing with γ-rays. Apparatus, radiation protection, error considerations, practical suggestions. (S13e)

43-S. (Italian.) **Ultrasonic Tests.** E. Martin. *Metallurgia Italiana*, v. 48, no. 6, June 1956, p. 261-271.

A study of the principle, various methods used, results in applying nondestructive ultrasonic material testing to railroad rolling stock in Germany. (S13g)

44-S. (Book—German.) **X-Ray Analysis of Metals. Röntgenographic der Metalle.** M. W. Maltsev. VEB Verlag Technik, Berlin, NW7, 240 p. 1955. $5.75.

A textbook for students and engineers working in metallurgical mills and in machine-construction fields, where nondestructive tests of materials are applied. Detection of material flaws, qualitative and quantitative analysis, crystalline structure, and phase analysis of alloys. (S13e, S11p, M22, M23)

Metal Products and Parts

1-T. High-Tensile Weldable Steel. Development of a Molybdenum-Chromium-Molybdenum-Vanadium Type for Pressure Vessels. W. Barr and I. M. MacKenzie. *Iron & Steel*, v. 29, Nov. 1956, p. 519-522.

General characteristics, response to heat treatment, notch ductility, weldability. (T26; AY,)

2-T. The Prospect for Precision Steel Castings in Aircraft. *Precision Metal Molding*, v. 14, Nov. 1956, p. 48-50, 86-87.

Possibilities of greater use of castings in aircraft for reasons of economy. Cast and wrought strengths of the commonly used alloys compared. (T24, Q23; ST, 5-12)

3-T. (Czech.) **Study of Silumin Pistons for Internal Combustion Engines.** Premysl Rys and Karel Hanak. *Slévarenstvi*, v. 4, no. 10, Oct. 1956, p. 289-297.

Tests carried out with pistons made from a silumin-type alloy to confirm the experience that pistons with bright surfaces have a greater seizing tendency than pistons with dull surfaces. (T21, Q9; Al)

4-T. (Italian.) **Characteristics of a New Light Alloy (Iridal) for Architectural Uses.** C. Panseri. *Alluminio*, v. 25, no. 10, Oct. 1956, p. 427-434.

Mechanical and structural characteristics of new heat treatable alloys containing boron. (T26; EG-a)

5-T. Special Heat of Austenitic Stainless Steel Used in the Experimental Breeder Reactor (EBR-1). Robert A. Noland and David E. Walker. *Argonne National Laboratory (U. S. Atomic Energy Commission)*, ANL-5548, Oct. 1956, 16 p.

The basis for specified composition, melting procedure, reactor components employing the material. (T11; SS)

6-T. Production of Honeycomb Sandwich Structures. George D. Cremer. *Metal Progress,* v. 70, Nov. 1956, p. 81-84.

Strong light-weight structures can be made by bonding two thin sheets of a strong material to an expanded honeycomb core. Adhesives are used for low-temperature service, brazed or welded joints for high-temperature applications. (T24, K general)

7-T. Which Steel for High-Temperature Piping? E. A. Sticha. *Petroleum Refiner,* v. 35, Nov. 1956, p. 185-189.

Recent developments in connection with ferritic, chromium-molybdenum, carbon and austenitic steels. (T29, 2-12; AY)

8-T. Development of U_3Si Epsilon Phase Alloys for Use in Pressurized Water Reactors. R. A. Wolfe, W. E. Bond, W. A. Bostrom, I. Cohen and R. B. Roof, Jr. *Westinghouse Electric Corporation, Atomic Power Division, (U. S. Atomic Energy Commission),* WAPD-155, July 1956, 73 p.

General properties and corrosion behavior of U_3Si alloys both with and without protective cladding. (T11, R general; U, Si)

9-T. (French.) **The Use of Stainless Steels Other Than 18/10 in Chemical Engineering.** J. Hochmann. *Génie Chimique (Supplemnt to Chimie & Industrie)* v. 76, no. 4, Oct. 1956, p. 97-105.

Shows significance of molybdenum and copper additions and the advantage of nickel-free ferrite steels and chromium-nickel manganese steels. (T29; AY, SS)

10-T. (German.) **High-Quality Cold-Deformed Concrete Reinforcing Bars Made of Converter Steel.** Hubert Hoff and Georg Fischer. *Stahl und Eisen,* v. 76, no. 22, Nov. 1, 1956, p. 1471-1479.

Use of conventional basic converter rimming steel and steel blown with oxygen showing tensile strengths corresponding to steel St37. (T26; ST)

11-T. (Polish.) **Steel-Aluminum Trolley Wires for Transportation Systems.** Leszek Godecki. *Hutnik,* v. 23, no. 9, Sept. 1956, p. 340-343.

Replacing copper trolley wires by cheaper aluminum-steel wire. The aluminum acts as the major conductor of the current while steel provides the necessary durability. (T1; Al, ST)

12-T. (French.) **Stainless and Refractory Steels in Aircraft.** L. Guitton. *Métaux, Corrosion-Industries,* v. 31, no. 374, Oct. 1956, p. 407-417.

A survey of the alloy steel used till recently in French aeronautics. New requirements for turbines, combustion chambers and tuyeres. The problem of creep. Application of refractory steels to turbojet engines. (T24; SG-h, SS)

13-T. (French.) **Present Metallurgical Problems in the Field of Refractory Steels.** W. Siegfried. *Métaux, Corrosion-Industries,* v. 31, no. 374, Oct. 1956, p. 418-431.

Qualities required in materials used in gas turbine construction. Progress made in various test techniques and in refractory steel production. (T24, T25; SS, SG-h)

14-T. Glossary of Alloys. *Petroleum Processing,* v. 11, Dec. 1956, p. 87-88.

Lists common alloys, by general and trade names used in refinery and petrochemical plants. (T29, 11-17)

W Plant Equipment

1-W. How to Control Temperature in Die Casting Dies. V. Die Design for Heat Control. W. M. Halliday. *Precision Metal Molding,* v. 14, Nov. 1956, p. 101 + 6 pages.

Design considerations required for efficient operation. (W19, 18-17)

2-W. Lining of Blast Furnaces With Carbon Brick. A. Send. *Henry Brutcher Translation No.* 3185, 13 p. (From *Stahl und Eisen,* v. 71, no. 25, 1951, p. 1361-1365.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 59-D, 1952. (W17; NM-h)

3-W. (Czech.) **Materials for Steam Generators and Turbines Operating at High Temperatures and Pressures.** J. Pluhar. *Strojirenstvi,* v. 6, no. 10, Oct. 1956, p. 677-683.

Optimum utilization of low alloy steels, properties of new steels and problems of welding austenitic steel. (W11, K general; AY, 18-2)

4-W. (Dutch.) **Acid Cupola Linings.** A. Bordes. *Metaalinstituut T. N. O.,* no. 40, June 1956, 12 p.

Practical data on raw materials, methods of patching and drying, wear of the lining, consumption of refractory materials, cost. (W18; NM-h)

5-W. (French.) **Practical Advice to Founders.** *Fonderie,* no. 128, Sept. 1956, p. 358-366.

Some practical rules for the correct construction of cast iron or steel flasks for hand finishing. (E19; CI, ST)

6-W. Flexible Batch Furnace Installation in Commercial Heat Treating Plant. Robert Grafmiller. *Industrial Heating,* v. 23, Nov. 1956, p. 2491 + 4 pages.

Economical, flexible installation, furnace operation, quenching control, atmosphere control. (W27)

7-W. Tunnel Annealing Furnace Speeds Stainless Parts Production. P. M. Unterweiser. *Iron Age,* v. 178, Dec. 6, 1956, p. 128-129.

New furnace provides continuous, short cycle for annealing work hardened TV tube housings made of Type 430. It means a reduced scrap rate and can be handled by one operator. (W27; SS)

8-W. A Comparison of Single and Multiple Stack Annealing Furnaces. John Arnold. *Iron and Steel Engineer,* v. 33, Nov. 1956, p. 77-82.

Advantages of single-stack operations include flexibility, lower installation costs, lower product inventory. (W27)

9-W. Intergrated Electro-Mechanical Press Puller Drive System Improves Extrusion Quality. R. C. Suttle. *Iron and Steel Engineer,* v. 33, Nov. 1956, p. 83-88.

Unit features reduced manpower requirements, installation ease, maintenance facility, accurate puller tension, and high-speed electrical response. (W24)

10-W. 16-8-2 Cr-Ni-Mo for Welding Electrode. O. R. Carpenter and R. D. Wylie. *Metal Progress,* v. 70, Nov. 1956, p. 65-73.

Difficulties cropping up with welded stainless equipment in high-temperature service have led to a new composition which is free from weld cracks and is superior to the usual Type 347 electrode in all respects except resistance to intergranular corrosion. (W29; SS, 18-2)

11-W. Metallic Muffle for High-Temperature Sintering. Edmund N. Mazza. *Precision Metal Molding,* v. 14, Dec. 1956, p. 44-45.

Inconel can be successfully and economically used for applications where the maximum temperature does not exceed 1350° C. (W17, 2-12; Ni, 18-2)

12-W. Filler Metals for Joining. Orville T. Barnett. *Welding Engineer,* v. 41, Dec. 1956, p. 54, 56, 59-60.

Advantages of iron powder electrodes include improved deposition rates, high strength, readily controllable slag, good mechanical properties of deposited weld metal, and decreased costs. (W29; Fe, 18-2)

13-W. (Russian.) **Increasing the Durability of Ladles.** N. A. Rokhlin. *Metallurg,* no. 10, Oct. 1956, p. 19-20.

Introduction of heavy lining for teeming ladles, permitting up to 11 melts. (W19; NM-h)

14-W. High Alumina Ladle Linings. V. J. Howard. *Journal of Metals,* v. 8, Dec. 1956, p. 1646-1647.

When handling high-temperature metals, the advantages of high alumina are low shrinkage, high strength, high density and high-temperature resistance. Proper ramming technique and fixing at high temperature before using the ladle are essential. (W19, E23; SG-h, NM-h)

15-W. Zircon Ladle Linings for Cleaner, Low Cost Metal. W. D. Emmett and V. E. Zang. *Journal of Metals,* v. 8, Dec. 1956, p. 1648-1649.

Zircon lining means longer ladle life, considerable savings in cost of lining per ton of metal poured and cleaner metal, but ladles are not easily kept clean of adhering slag and the mix sets up very hard, causing a greater length of time to knock out. (W19, E23; NM-h)

X Instrumentation

Laboratory and Control Equipment

1-X. (Russian.) **Dilatometer for the Study of Phase Transformations in Alloys.** V. G. Permiakov and M. V. Belous. *Zavodskaia Laboratoriia,* v. 22, no. 10, Oct. 1956, p. 1251-1252.

Design, operation and degree of accuracy of device for laboratory determinations of coefficients of linear expansion and phase transformations. (X24, N6; AY)

2-X. Acidity Control in Zinc Electrolysis. Georg Steintveit. *Journal of Metals,* v. 8, Nov. 1956, p. 1542-1543.

The acidity control instrument described may be used as a time-saving control method in any industry where a simple relation exists between conductivity of an electrolyte and the concentration of one of its constituents. (X25; Zn)

3-X. Climbing Peel Test for Strength of Adhesive Bonds. Fred Werren and H. W. Eickner. *Modern Plastics,* v. 34, Dec. 1956, p. 187-188, 190, 264.

Apparatus is applied to the testing of aircraft sandwich materials with thin facings. (X29, 7-8)

4-X. (German.) **Mixing Calorimeter for Measurement of Metallic Mixed Phase Enthalpies Between 25 and 1000° C.** Franz Eberhard Wittig and Georg Böhm. *Zeitschrift für Metallkunde,* v. 47, no. 10, Oct. 1956, p. 699-704.

A calorimeter which automatically drops the specimens into the bath is described. (X24, P12r)

5-X. (German.) **Measuring Temperature in the Basic Converter.** Helmut Knüppel, Karl Ernst Mayer, Gert Wiethoff, Kurt Doffin and Walter Koch. *Stahl und Eisen,* v. 76, no. 22, Nov. 1, 1956, p. 1410-1416.

Apparatus and its uses, practical results. (X9, D3)

6-X. (English.) **A New Electrolytic Cell for the Isolation of Carbides and Nonmetallic Inclusions in Steel.** Nils Bäckström, Sakari Heiskanen and Urpo Ilme. *Jernkontorets Annaler,* v. 140, no. 10, 1956, p. 812-816.

General requirements, design, use. (X4; NO-a35, ST, 9-19)

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METALLURGIST: B.S. degree, age 24, family. Nine months experience with leading toolsteel manufacturer. Two years heading metallurgical laboratory in Air Force. Extensive background in group administration. Desires position leading to management responsibilities with progressive metal producing or metal fabricating industry. Not interested in laboratory research. Available April 1957. Box 1-30.

SALES-MANAGEMENT: M.S. in metallurgical engineering, age 42, married. Located Southern California. Have held only three positions in 17 years of continuous employment. Sales, research and management experience. Desires change from present management position. Seeks position with growth potential and challange to spend remaining 23 years of anticipated employment span. Box 1-35.

AIRCRAFT METALLURGIST: B.S. degree, seeking responsible position that could effectively utilize 10 years diversified experience in research, diffraction, corrosion, metallography, trouble shooting, heat treatment and quality control. Box 1-40.

METALLURGICAL ENGINEER: B.S. degree, University of Pittsburgh, age 29, married. Four years diversified experience with large steel producer of bar and sheet products in Pittsburgh district. Currently attending evening classes for M.A. degree. Energetic. Desires position of varied responsibilities that will utilize education and develop into executive capacity. Will consider relocation. Box 1-45.

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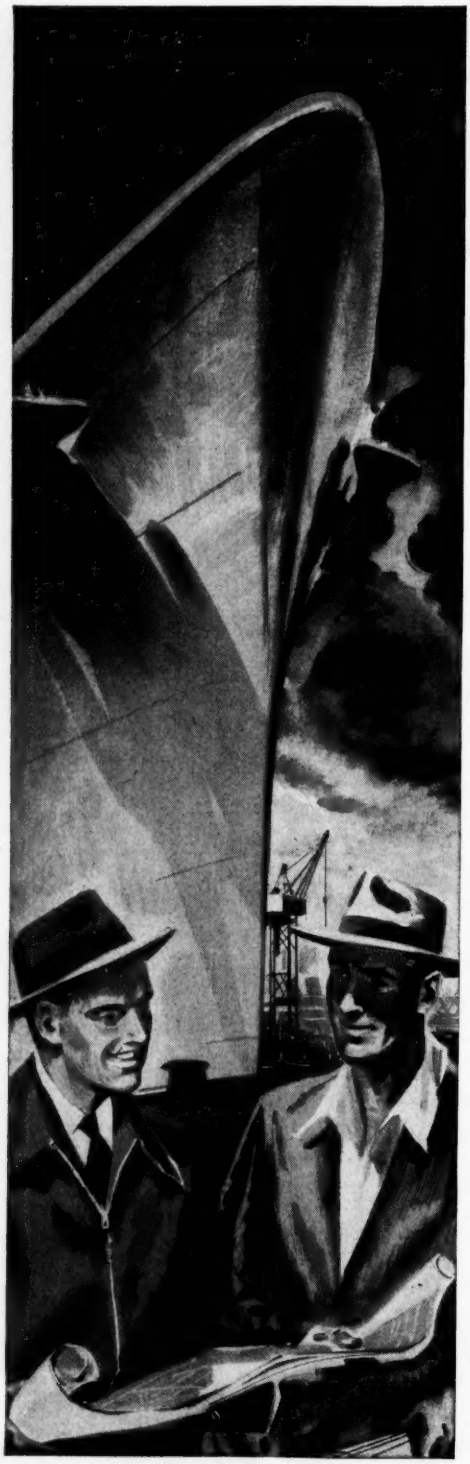

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METALLURGIST: B.S. degree from McGill University, Canadian, age 32, veteran, single. Technical experience consists of two years in nonferrous extractive metallurgy development and four years aircraft industry dealing with ferrous and nonferrous materials processing, including heat treating, forming, welding, surface treatments, etc. Interested in development work with chances for advancement in U. S. company, preferably on West Coast, but would consider any area. Box 1-55.

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METALLURGICAL ENGINEER: Nine-year background in applied research and development in nuclear metallurgy, refractory metals, cermets, destructive and nondestructive testing, interpretative metallography, heat treatment, melting and casting, bonding, metal fabrication. Position must require this background in a technical, administrative category. Location in Metropolitan New York, New Jersey or Connecticut. Box 1-95.

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(Technical)
NEEDED

REQUIREMENTS

Ph.D., M.S., or B.S. degree and minimum of four years' experience.

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In development and production departments: Applied non-ferrous (uranium and alloy metals) metallurgy involving reduction, casting, and fabrication of metals... investigation of hot forming methods and metallography studies of metal quality.

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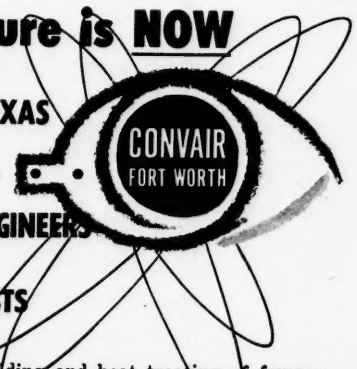

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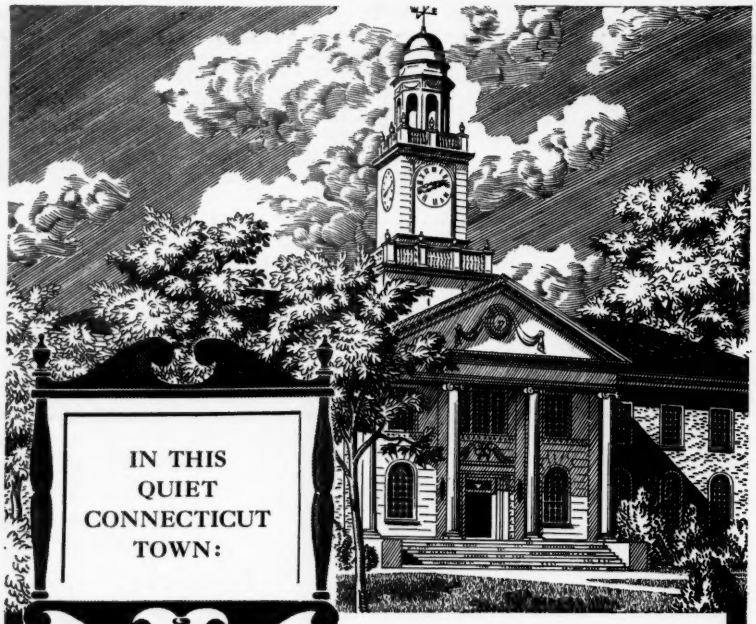

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(Technical)
NEEDED

REQUIREMENTS

Ph.D., M.S., or B.S. degree and minimum of four years' experience.

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Class 5. Uranium, plutonium, thorium, zirconium and reactor fuel and control elements.
Class 6. Metals and alloys not otherwise classified.
Class 7. Series showing transitions or changes during processing.
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METALS REVIEW

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☐ Enroll me; $125.00 registration fee enclosed

☐ Send me more information

Name _____

Company Affiliation _____

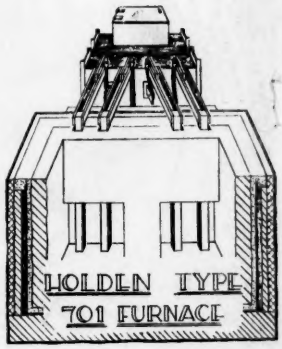
Address _____

City _____ State _____

HOLDEN
METALLURGICAL PRODUCTS
TRADE MARK REGISTERED

are MONEY MAK-ERS for INDUSTRY

JOIN THE PARADE



HOLDEN Salt Baths = QUALITY CONTROL

ADDITIVES REPLACE
1. Carbon Rods
2. Rectifiers
3. Gas Rectifiers

DOWN TIME---------- How much per day?

DOWN TIME WITH ADDITIVES ---------- NONE!

How YOU can change to HOLDEN Salt Baths with Additives–

1. Send 1 lb. sample of salt in furnace.
2. Send 1 lb. sample of salt as purchased.

We will furnish (FREE) correct additives with original purchase order.

Purchase and add HOLDEN SALT BATH QUALITY CHEMISTRY to your production operations.

FREE Holden Literature: (NEW)

#200—Holden Salt Baths
#201—Holden Pot Furnaces
#203—Rubber Mold Cleaning, Paint Removal, Descaling & Desanding
#204—Pressure Nitriding
#205—Industrial Furnaces
#206—Austempering-Martempering
#207—NEW—Recirculation Radivection Furnace . . . 300° to 1750° F.

THE A. F. HOLDEN COMPANY

DETROIT 27, MICH. • 14341 Schaefer Highway
LOS ANGELES 58, CALIF. • 4700 East 48th Street
NEW HAVEN 8, CONN. • 460 Grand Avenue